OPERATING MANAGEMENT'S
OWN MAGAZINE . . .

CHEMICAL PROCESSING

OCTOBER 1961

Who Should Pay For Equipment Tests?

CP survey points up things to consider in tackling joint program of trials . . 27

Tris Amino' Upgrades Alkyd Resins

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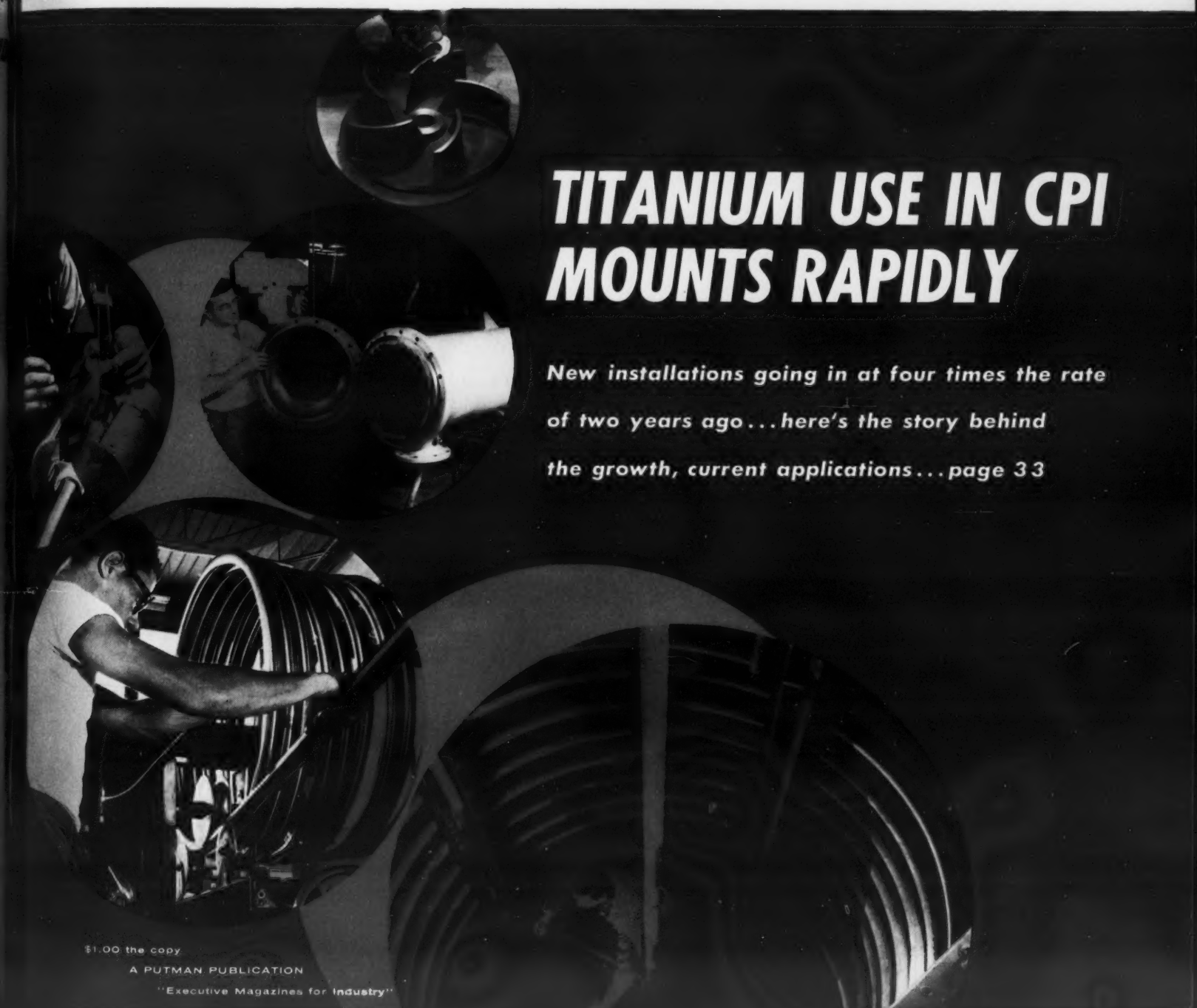

TITANIUM USE IN CPI MOUNTS RAPIDLY

New installations going in at four times the rate of two years ago . . . here's the story behind the growth, current applications . . . page 33

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THAT'S INTERESTING

Henpecked no longer

U.S. farmers who have had to mass-spray flocks of chickens or treat birds individually to rid them of lice, other parasites, are learning to let the hens do it themselves.

The solution is simple—put a box containing about a pound of malathion insecticide in the pen—one box per 30 chickens. The birds do the rest by bathing in it.

Seals fate of lube job

Owners of a certain 1961 model car can doff their hats to a liquid urethane rubber for relegating to the past the irksome 1000-mile lubrication chore. The Dupont elastomer is used to make a seal for front suspension joints that hold grease in and contamination out for 30,000 miles.

For more information on product at right, specify 1001 see information request blank opposite last page.

General

2-NP ($CH_3CHNO_2CH_3$) is a member of the extraordinarily versatile CSC Nitroparaffin family. Its most outstanding characteristic is its unique solvent property which permits the use of larger proportions of low cost alcohols and aromatics in solubilizing a wide variety of coating materials, dyes, organic chemicals, fats, and oils. This unique property is of special interest in the formulation of vinyl and epoxy coatings.

Solvent for Vinyls

With the introduction of 2-NP—for the first time—formulators of vinyl chloride-acetate copolymers were able to obtain coatings with 1) lower viscosity and/or higher solids, 2) medium evaporation rate with better flow, 3) improved solvent release resulting in reduced drying time, and 4) mild odor. In addition to these advantages, the ability of nitrated solvents to displace water results in coatings with better adhesion to hydrophilic surfaces and better weathering properties due to improved dispersion. 2-NP's high flash point and low volatility provide added safety factors.

Research and field experience in the packaging industry have shown that the high solids content of 2-NP-formulated vinyls offers important advantages in the high-speed coating of food and beverage containers. 2-NP also proves useful in vinyl ink applications since it does not attack gelatin or most rubber rolls but still provides outstanding adhesion or "bite" to many plastics.

Low Viscosity and/or High Solids Content

2-NP can be formulated to give vinyl solutions of higher solids content and/or lower viscosity than any other medium evaporating solvent. In addition, 2-NP solutions have good stability and show no tendency to gel.

Reduced Cost

In VYHH* solutions, to obtain comparable solids and viscosities, a 50-50 mixture of MIBK-toluol can be replaced by a 30-70 mixture of 2-NP-toluol. This makes it possible for a vinyl formulator to save over $600 in raw material costs for each tank car of MIBK he now uses.

Solvent for Epoxies

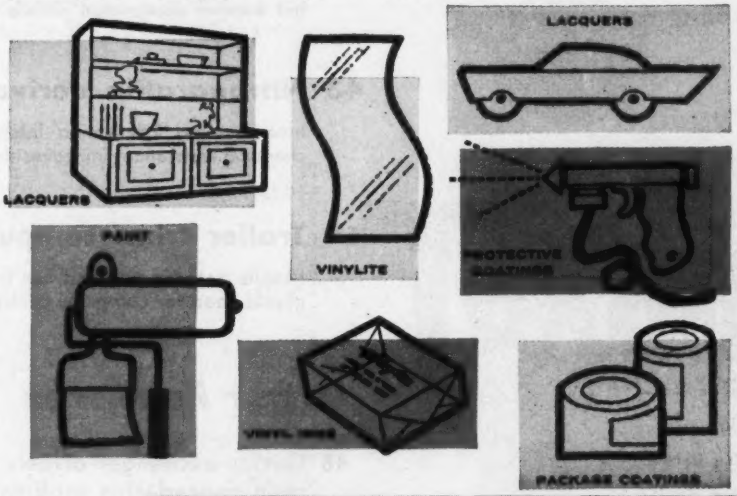
Solvent mixtures based on 2-NP have been found to be superior to other solvent systems for epoxy coatings cured at room temperature. Improvments brought about by the use of 2-NP include much greater chemical resistance, marked reduction in pinholing and water vapor permeability, minimized crawling and cratering, and improved adhesion.

2-NP is compatible with amine catalyzed systems (with the exception of ethylene diamine) and systems employing urea-formaldehyde, polyamides, or phenolic cross linking agents.

The ability of nitrated solvents to wet pigments and hydrophilic surfaces, as previously mentioned in the section entitled *Solvents for Vinyls*, also applies to epoxies as well as other vehicles used by the coating industry.

Want more information on 2-NP for Vinyls and Epoxies?

If you would like to have test samples and complete technical data on 2-Nitropropane for your vinyl and epoxy formulations, fill in and mail the coupon below.



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COMMERCIAL SOLVENTS CORPORATION
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CHEMICAL PROCESSING HIGHLIGHTS

OCTOBER 1961

VOLUME 24 • NUMBER 10

Special This Month

THIS MONTH'S COVER

Increasing tempo of titanium installations in the CPI is suggested by the cover, showing typical uses and improved fabrication procedures. Four-page feature article, which tells why titanium has caught on in chemical processing plants and discusses how it can be used to cut costs, starts on page 33. List of key titanium suppliers and fabricators is included as a source of further information on specific problems.

INDEX

Other Features

recent books

Starting with olefin raw materials and concluding with purified polymer, "Polyolefin Resin Processes" includes a discussion of catalysts and solvent recovery with attendant steps between olefin and polyolefin. Book covers solid rather than liquid or viscous polymers and concentrates on resins, homopolymers of aliphatic mono-olefins and some copolymers of olefins with other olefinic hydrocarbons.

In addition to 207 pages of text, flow sheets and graphs, volume provides most comprehensive review of U. S. patents in the polyolefin resin process field ever published. Patents are listed in order of application.

To obtain "Polyolefin Resin Processes" by Marshall Sittig, remit $6.50 direct to Gulf Publishing Company, Book Division, 3301 Buffalo Drive, Houston 1, Texas.

Check 1002 opposite last page.

The impact achieved by professional engineering unions is discussed in 420-page book written by R. E. Walton, associate professor of industrial management, Purdue University. The work reports on research into the experiences of 11 companies where professionals have organized certified bargaining units.

The study concludes that management's interests are affected in two ways. First, management flexibility and other operating standards for the firm are affected, sometimes adversely and sometimes favorably. Second, management's own leadership status and authority are seriously challenged.

To obtain "The Impact of the Professional Engineering Union" remit $5.00 direct to Harvard Business School Div. of Research, Soldiers Field, Boston 63, Mass.

Check 1003 opposite last page.

Over 200 collaborators, who are recognized authorities in their own science research fields, have contributed to make up the nearly 3500 pages of data contained in the useful, versatile "Handbook of Chemistry and Physics" 43rd Edition. Nearly 80 pages of new material, plus revised and expanded data, update this one-source reference for facts on mathematics, physics and chemistry.

New tables included: color code for electrical resistors; lattice energies of alkali halides, sound velocity in water above 212°F; Van der Waals' radii in A°. Expanded data on steroid hormones, masses and mean lives of elementary particles, and thermal neutron cross sections are presented.

To obtain, "Handbook of Chemistry and Physics" 43rd Edition remit $12.00 direct to The Chemical Rubber Company, Publications Division, 2310 Superior Ave., Cleveland 14, Ohio.

Check 1004 opposite last page.

CHEMICAL PROCESSING

OCTOBER 1961
VOLUME 24 • NUMBER 10

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CHEM-TRENDS / Our Growing Industry

Canadian potash lures U.S. Borax as IMC spends $10 million more there

By January 1963 demand for North American agricultural potash is expected to be zooming upward at a 6.5% annual rate.

In the eyes of at least two leading producers, **International Minerals & Chemical Corporation and United States Borax, & Chemical Corporation** Saskatchewan, Canada, site of the world's largest known deposit of high grade ore, offers the best bet for keeping pace with that demand.

International Minerals hasn't been able to meet current needs the past few years despite intensive efforts at its Carlsbad, N.M., operations. However, IMC expects to be ready in 1963 when its $40-million investment at Esterhazy, Saskatchewan, begins to produce at a 1.2-million-ton/yr rate.

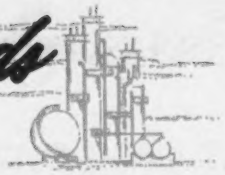
IMC had started building a 420,000-ton/yr facility; then a few weeks ago decided to beef up the facilities under construction by spending $10 million more.

Now U.S. Borax is joining forces with Homestake Mining Company to study the possibility of building large-scale facilities in Saskatchewan. A jointly-owned company would be organized to operate the facilities.

Under a contract with the Bureau of Mines, **Cities Service** will build a giant helium extraction plant on an 80-acre site near Ulysses, Kas. Capacity will be 2 million cu ft/

To page 10

Chem-trends



Manufacturing cost differences narrowing between here & abroad, survey reveals

Cost differences between manufacturing here and abroad have narrowed since a similar survey was conducted in 1956. When foreign costs are lower, it is invariably due to labor expense advantages.

This is the substance of a study on experiences of U.S. concerns manufacturing both here and abroad. Recently issued by National Industrial Conference Board, the report was based on 249 sets of cost data for products made both here and abroad, together with experience interpretations of 147 companies.

Disadvantages foreign manufacturers have to overcome include generally higher materials costs, smaller volume of operations, and usually absence of labor-saving process innovations.

Geographic area of operation exerts the greatest influence on costs, with Germany generally being lower than other Common Market countries. The latter, along with Great Britain are able to undersell the U.S., which, in turn, is lower than Latin America or Australia. ■

Chemicals producers, petroleum refiners lead capital appropriations upswing

Capital appropriations for expansion and modernization of production and distribution facilities are on the upswing for all major industry groups except railroads.

For the last quarter of '61, investment dollars will be spent at a rate 7% higher than for the June quarter, achieving a rate of $35.9 billion, figured on an annual basis.

Such predictions are part of a quarterly survey report issued by the Commerce Dept. and the SEC.

Soft goods producers (of which chemicals and petroleum refining lead), utilities and the finance-trade-construction group plan to boost their fourth quarter investments 8-12% above those of the June quarter. ■

Processes — Larger water demineralization plants than those in the present demonstration program will have to be built before costs beneath 50¢/M gals can be proved, according to Office of Saline Water staff specialist W. W. Rinne. He further reveals that the freezing-out process is currently viewed as of greatest potential for demineralizing seawater . . . Countries which have no internal sources of carbon black and which are also short on natural rubber may be able to have heavy-duty automotive tires which require neither of these materials. This is the inference of results of tests conducted by the Canadian Army Quartermaster General's Dept. The tests showed that military-type tires of lignin-reinforced synthetic rubber, containing only 12% natural, held up as well under severe driving conditions as the standard C-black & natural rubber tires. . . . Quarrying in Germany is being done with oxygen-hydrocarbon jet flames being used to channel-out stone blocks for removal; the process has been adopted from the technique followed by Union Carbide Corp. ■

International — The Germans, not exactly inexperienced with centralization, have come out in favor of a Federal Ministry for Science. At least a leading organization — German Assn of Technological Societies (DVT) — has so advocated, by approving and forwarding a resolution to this effect to the Office of Chancellor Adenauer. Only by such a ministry can German science command the budgetary support and political power necessary to fulfill its potential for the greatest good for the country as a whole, the DVT has stoutly insisted. ■

Distribution — Look to widespread use of liquid nitrogen sprayed directly into the interiors of truck-trailers for refrigeration of contents under transit, particularly for perishable products kept just above freezing. Peak load conditions experienced during chilling prior to loading, following opening of doors, and during midday-heat can be accommodated by only regulating nitrogen injection.

Equipment — Wide sheets and plate of tungsten and molybdenum will soon be in production at G-E's Euclid, Ohio, plant. Initially to serve high-temperature-materials needs of missile program, availability of stock ranging from 0.15 to 0.5 in thickness, should offer intriguing possibilities to chemical equipment builders. . . . A 200-watt solar-driven pump, under evaluation by Westinghouse, is expected to revolutionize irrigation.

Materials — Ammonium nitrate, alone and in combination with hydrocarbons, will be the subject of extensive research to determine fire hazards by Bureau of Mines, under sponsorship of MCA.

Community — Brownsville, Texas, gets a new breath of life as Union Carbide begins its first new petrochemicals production at a plant on the site of the abandoned Carthage Hydrocol project . . . *Pollution* — As the result of chromatographic studies, peroxyacetyl nitrate (PAN) is found to be the major oxidant-damager and lacrymator in polluted air.

OUR GROWING INDUSTRY

From page 8

day of helium. It will be extracted from the stream of gas from the Kansas-Hugoton field.

Pacific Engineering & Production Company will increase capacity for ammonium perchlorate from 7½ to 17 ton/day with multi-million-dollar expansion at Henderson, Nev. Completion is expected early in 1962.

Monsanto Chemical Company's Inorganic Chemicals Division early next year plans to build at Augusta, Ga., a plant which initially will produce phosphoric acid and sodium tripolyphosphate for the growing southeastern detergent, fertilizer and metal treating industries.

A $10-million nitrogen products plant will be built near Clinton, Ia., by **Hawkeye Chemical Company,** formed on a 50-50 basis by **Swift & Company** and **Skelly Oil Company.** Plant will have 300-ton/day capacity. Swift also recently revealed plans to build 600-ton/day sulfuric acid plant in Florida—part of $30-million, two-year program to strengthen its agchem business.

Cary Chemicals, Inc., bent on moving into new vinyl fields, has awarded a $4-million contract to **Blaw-Knox Company** to design and build two PVC plants with 100-million-lb/yr total capacity. First plant is to be on stream next June; the second will be started within 12 months. The plants will front on the Delaware river west of Burlington, N.J.

MERGERS continued to sprout, mature and bear fruit in the CPI with some interesting hybrids resulting. **Spencer Chemical Company** wrapped up two of its recent acquisitions, Flexicraft Industries, Inc. and Wrapture, Inc., in a new company, **Flexicraft-Wrapture, Inc.,** with headquarters in New York City. Robert Burg, formerly Flexicraft prexy, will head the new subsidary; and Samuel Riv-

man, Wrapture's former president, becomes v.p.—development.

Diversification into non-government fields is one of the benefits cited by Martin executives in behalf of the proposed merger of **Martin Company** and **American-Marietta Company** into Martin-Marietta Corporation. Stockholder action was scheduled for Oct. 9.

Diamond Alkali Company has added **Bessemer Limestone** and **Cement Company** as Bessemer Cement Company division. Recently Diamond also acquired all stock of **Chemical Process Company.**

Chas. Pfizer & Co. swapped 45,000 shares of stock for **Globe Laboratories, Inc.,** Fort Worth, Texas; thus gaining entry into the field of animal biologicals.

Directors of **Cities Service Company** and **Columbia Carbon Company** have okayed their proposed merger, subject to stockholder assent.

Catalin Corporation of America acquires a fourth plant with purchase of **Lebec Chemical Corporation,** Paramount, Calif., producer of synthetic resins. Lebec's president, John C. Plummer becomes Catalin v.p. and director.

Hood Chemical Co., Ardmore, Pa., is now a division of **Texize Chemicals, Inc.,** Greenville, S.C.

Kenrich Petrochemicals, Inc. has purchased 1/6 of the outstanding stock of Wichita River Oil Company.

Polyply, Inc., Amsterdam, N.Y., has purchased the **Reinforced Plastics Division** of Fiber Glass Industries, Inc.

Directors of both **Pemco Corp.,** Baltimore producer of inorganic coatings, and **Glidden Co.** have approved the proposed merger which would make Pemco a unit of Glidden's Chemicals Group. Glidden recently designated its four major divisions as

"groups." These are: the Coatings and Resins Group, the Durkee Famous Foods Group; the Chemicals Group; and the International Group.

American Potash & Chemical Corporation has given **C. F. Braun and Company** the contract for designing its titanium dioxide plant near Mojave, Calif.

A multi-million-dollar expansion will approximately triple phosphoric acid capacity of **National Phosphate Corporation's** Marseilles, Ill., facilities. In addition, expansion will enable the company to upgrade some acid to diammonium phosphate and integrate its raw material position through construction of a sulfuric acid plant and a molten sulfur terminal. Work is to be completed by mid-1962.

Houdry Process Corporation is doubling its triethylenediamene capacity by erecting a second plant at Paulsboro, N.J. **Catalytic Construction Company** will build the foam catalyst plant.

Baird Chemical Industries has awarded the task of designing and building its new **Sorbitol** plant to **Badger Manufacturing Co.** The $1.5 million plant will have 20-million-lb/yr capacity. A 40-acre site has been selected at Peoria, Ill.

This month **DuPont** will start construction of a new methanol plant near Huron, Ohio. The multi-million-dollar plant will have 30-million-gal/yr capacity.

Allied Chemical Corporation will construct a phthalic anhydride facility on the site of its plant at El Segundo, Calif. Output, expected late next year, is earmarked for the West Coast.

Standard Oil Co. of California will build a 30-million-lb/yr phthalic anhydride plant at Perth Amboy, N.J. The project will be handled by Oronite division of California Chemical Co., a Standard subsidiary. ■

THAT'S INTERESTING

Propelling spacemen

Ten years ago some of the titles of reports currrently being issued by Uncle Sam's Office of Technical Services would have qualified only for the pages of a science fiction magazine.

For example, one new release is entitled "Self-Maneuvering for the Orbital Worker." Written by two USAF captains, it concludes that gyroscopic devices with torque-induced precession, used with rocket propulsion appear to be most promising methods.

Removable tire treads

Motorists will be able to use the same tire for both winter and summer driving due to removable tire tread developed by a European manufacturer.

Low-stretch characteristics of rayon tire yarn make the development possible, Dr. Mark Abbott of Courtaulds Canada Ltd., reports.

For more information on product at right, specify 1012 see information request blank opposite last page.

Spotlight On People

Humble board creates new post — board chairman — for Davis

From geologist to board chairman in 36 years sums up the career of **Morgan J. Davis** with Humble Oil & Refining Company. Davis, recently advanced from president to newly created position of board chairman, continues as chief executive officer of the company.

Carl E. Reistle Jr. was advanced from executive vice president to president, succeeding Davis.

Chemetron Corporation has dissolved its subsidiary Dunham Chemical Company and organized a Chemical Specialties Department built around Dunham marine combustion catalysts and detergents plus the metalworking compounds of another subsidiary, Northwest Chemical Company. **Harold J. McCracken,** Northwest Chemical president, is general manager of the new department of Chemetron's Chemical Products Division.

Spencer Kellogg Division, recently acquired by Textron Inc., has two new executive vice presidents, **Robert L. Terrill** and **Dr. Paul E. Newman.** Both are former Spencer Kellogg executives. Terrill will be in charge of the entire vegetable oil seed operation as well as special chemical products. Dr. Newman will be responsible for animal feed products.

Dr. Thomas L. Gresham, formerly vice president—R&D of the A.E. Staley Manufacturing Company, has been elected vice president of Air Products and Chemicals, Inc.

Charles A. Suter has succeeded **William F. Zipse** as president of Geigy Chemical Corporation. A veteran of 58 years with Geigy, Zipse is now chairman of the executive committee. Since 1950, Suter has been executive vice president of Geigy.

Dr. Maurice L. Moore has moved up from director of new products development of Sterling Drug Inc. to executive vice president of Winthrop Laboratories, Sterling's principal pharmaceutical manufacturing organization.

Amcel Propulsion, Inc. has a new vice president and general manager in **Fredric M. Cooper,** formerly director of engineering.

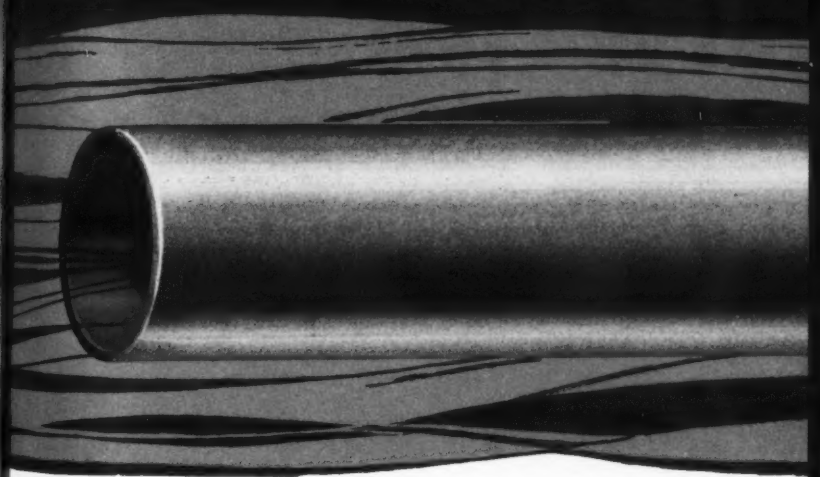
An executive shift in Union Carbide Corporation moves **Richard S. Abrams** from general manager of the Silicones Division to manager of development, Union Carbide Olefins Company. **James C. Malone** succeeds him as general manager of the company's Silicones Division.

In a trans-Atlantic job shift, **Dr. Reginald F. Webb** moves from director of R&D for Ciba, Ltd., Duxford, England, to director of research, Plastics Division, Allied Chemical Corporation. Elsewhere in the Allied family, **Carl R. Thomas** has been appointed plant manager of the Chesterfield, Va., fiber plant of the National Aniline Division; and **Paul B. Cornell** has been named assistant manager of the Solvay Process Division plant at Moundsville, W. Va.

Formerly director of manufacturing for Monsanto Chemical Company's Inorganic Chemicals Division at St. Louis, **B. Ross Nason** is now director of manufacturing and engineering for Mobay Chemical Company, Pittsburgh. Manufacturing responsibilities for ethylene operation at Monsanto's Chocolate Bayou plant near Alvin, Tex., have been assigned to **Glenn D. Rucker,** who was formerly in charge of ethylene operations at the

To page 16

WOLVERINE TITANIUM HEAT EXCHANGER TUBE IS CORROSION RESISTANT IN ALL THESE SERVICES



In addition to great corrosion resistance Wolverine titanium heat exchanger tube also offers extreme lightness and high strength in relation to weight. The combined results of these advantages are illustrated in the following comparative heat exchanger costs table. See how they can add up to *real savings* for your company.

METAL	A	B	TITANIUM
a. Cost per pound	$0.80	$3.00	$10.00
b. Pounds required	1,000	1,200	600
c. Material cost (a x b)	$ 800.00	$3,600.00	$6,000.00
d. Fabrication cost	$3,000.00	$3,500.00	$3,500.00
e. Total equipment cost (c + d)	$3,800.00	$7,100.00	$9,500.00
f. Cost ratio	1	1.92	2.5
g. Average service life	1 yr.	2 yrs.	5 yrs.
h. Cost per service year (e ÷ g)	$3,800.00	$3,550.00	$1,900.00

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CHEMICALS & SALTS

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Calcium Chloride
Calcium Hypochlorite
Carbon Tetrachloride
Copper Sulphate
Cupric Chloride
Ferric Chloride
Hydrogen Peroxide
Hydrogen Sulfide
Manganese Chloride
Magnesium Chloride
Mercuric Chloride
Nickel Chloride
Potassium Chloride
Sodium Carbonate
Sodium Chlorate
Sodium Chloride
Sodium Hypochlorite
Sodium Nitrate
Sodium Phosphate
Sodium Sulphide
Stannic Chloride
Sulphur Dioxide
Zinc Chloride

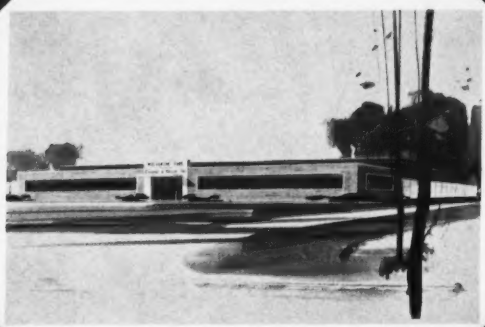
ACIDS

Acetic Acid
Acetic Anhydride
Chloroacetic Acid
Chromic Acid
Citric Acid
Lactic Acid
Nitric Acid
Oxalic Acid, Aerated
Phosphoric Acid
Stearic Acid
Tannic Acid
Tartaric Acid

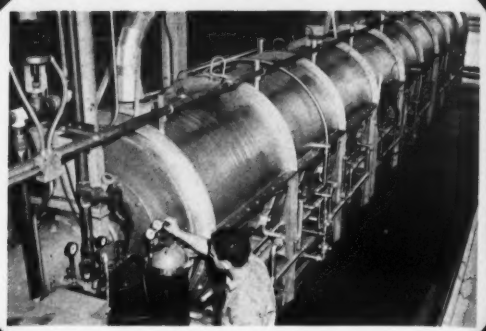
MISCELLANEOUS

Chlorinated Water
Chlorine Gas, Wet
Chloroform
Formaldehyde
Phenol
Salt Brine
Vinegar & Salt
Water, Sea or Salt

A WORD ABOUT OUR FACILITIES

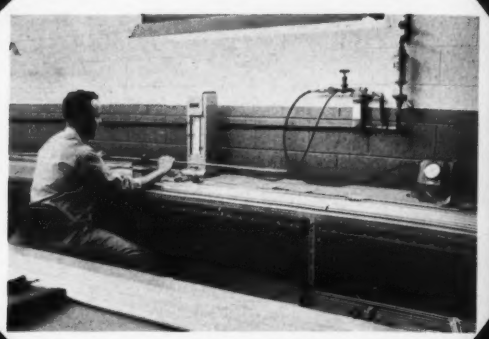


Wolverine Special Metals Plant



This Vacuum Annealer Is 135 Feet Long

Black Light Boroscope Testing



Air Gauge Test For Dimensional Accuracy

In Inkster, Michigan, Wolverine Tube operates the largest plant in the United States devoted exclusively to the production of tubing from special metals such as titanium and zirconium.

This is of major importance to tubing users. For, example, a separate facility such as this is invaluable in the minimization of alloy contamination–a highly desirable end result in tubing manufactured from special metals.

In addition to these special metal facilities Wolverine Tube, at its headquarters in Allen Park, Michigan, also maintains the tubing industry's largest research and development plant. Thus, Wolverine customers are assured of the very latest technological advances in all areas of tube manufacturing.

Because of these unique facilities you can be certain that Wolverine Tube can meet your tubing requirements–whether they be for seamless tubing manufactured from titanium and zirconium or from nonferrous metals and alloys. Write for complete information . . . or, ask your Wolverine Tube salesman – HE KNOWS!

FILL IN AND MAIL FOR COMPARATIVE ANALYSIS

Gentlemen:

We are interested in the possibility of using titanium heat exchanger tubing in our heat transfer operations. Will you please have your Heat Transfer Specialists analyze the following technical data and advise us if Wolverine titanium heat exchanger tube would be practical under the following conditions?

1 What is metal or alloy presently used?_____

O.D. and wall thickness?_____ Quantity?_____

2 Describe corrosive product with percent of concentration and t

perature of normal use._____

3 What is maximum temperature of corrosive product?_____

4 What is operating pressure?_____

5 What is present tube life?_____

NAME_____ TITLE_____

COMPANY_____

ADDRESS_____

CITY_____ ZONE_____ STATE_____

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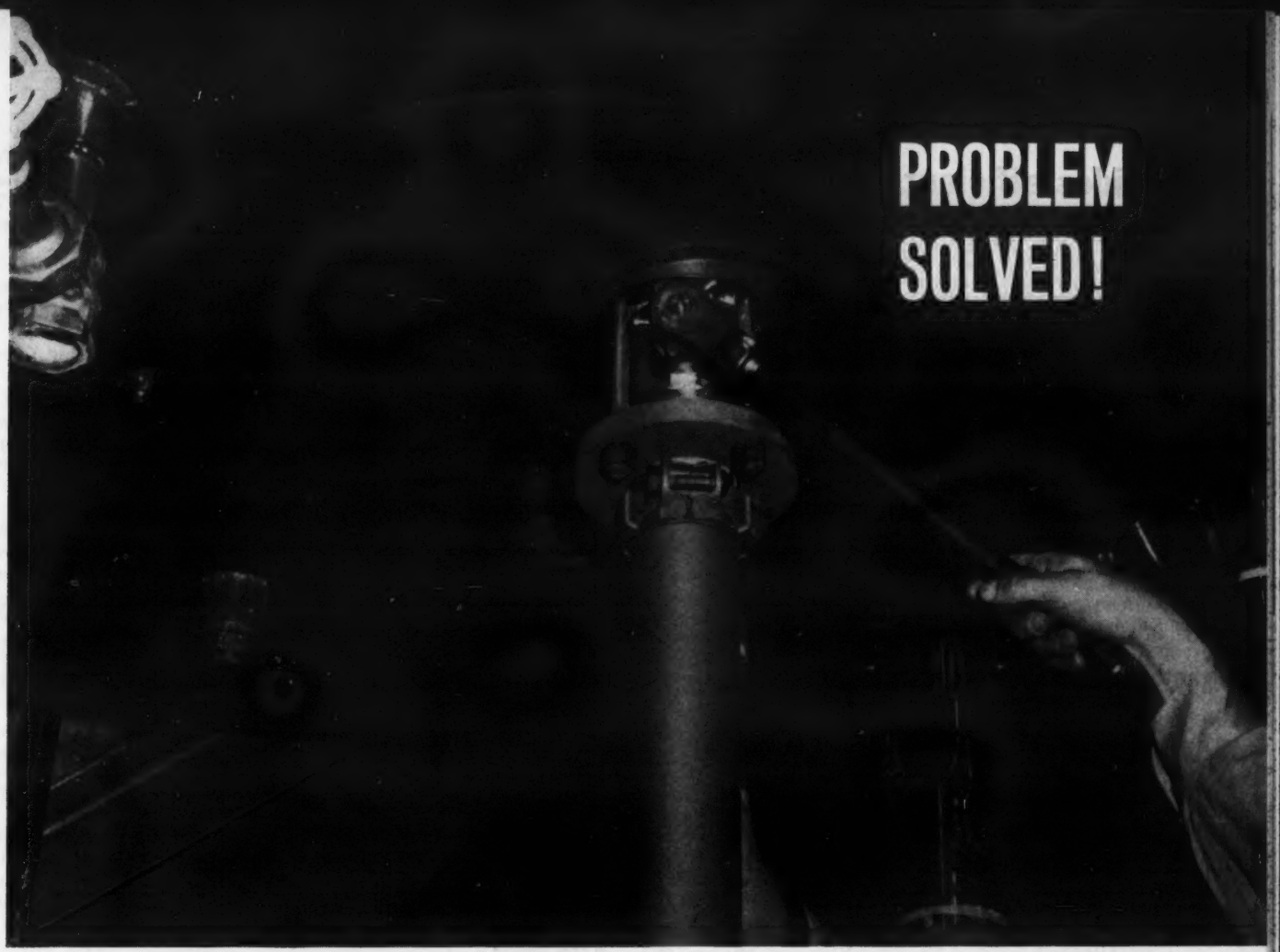
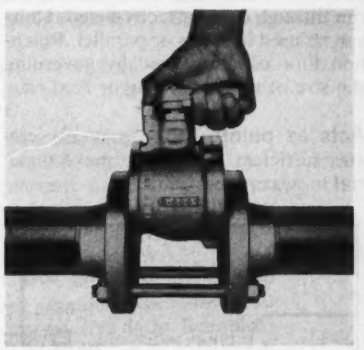


A 3" Econ-O-Miser Ball Valve Controls Abrasive Slurry at Pantasote Company

The combination of several unique design features of the Flange Econ-O-Miser Ball Valve helped solve a troublesome problem at Pantasote Company, Passaic, New Jersey, makers of polyvinyl chloride resin. This fluid, actually a granular solid slurry, required a valve with a wiping action. With the Econ-O-Miser design, the ball is wiped clean by the seats each time the valve is operated eliminating the danger of binding or of trapping solid material. A ball valve was selected over a gate valve because the ¼ turn feature allows operation from the floor by using a lever, and the position of the lever indicates whether the valve is open or closed.

The body of the Econ-O-Miser ball valve mounts directly on the flange of the vessel, without the usual flange pipe end. This eliminated any dead space where "puddling" could effect the reaction. Econ-O-Miser Ball Valves can provide similar installation advantages, superior performance, and substantial dollar savings for you!

Econ-O-Miser Flange Ball Valve . . . 3" Size Illustrated. Size Range . . . ¼" through 6". Seat and Seal Materials . . . Buna-N, Teflon and Neoprene. (Other Materials Available.)



For more information on product at right, specify 1016 see information request blank opposite last page.

Write for complete technical information, or contact your local Worcester stocking distributor!

WORCESTER VALVE CO., INC.

17 PARKER STREET, WORCESTER, MASS.

New 10″ pipeline homogenizer

...provides efficient, high-volume, air-free mixing without a tank.

New 30 to 60 hp HOMO-MIXER, *largest standard pipeline homogenizer, uses proved Eppenbach mixing head. Recommended for dispersing pigments, catalyzing resins, blending or dispersing in volatile materials, etc.*

Operating principle

High-speed turbine-rotor draws product in, shears it in fine clearances between rotor and stator, and forces it through restrictive openings in stator. Intense impact and hydraulic shear breaks down agglomerates, quickly wets out and disperses finest solids.

Advantages

Low initial cost. Mixing tank or vessel is eliminated.

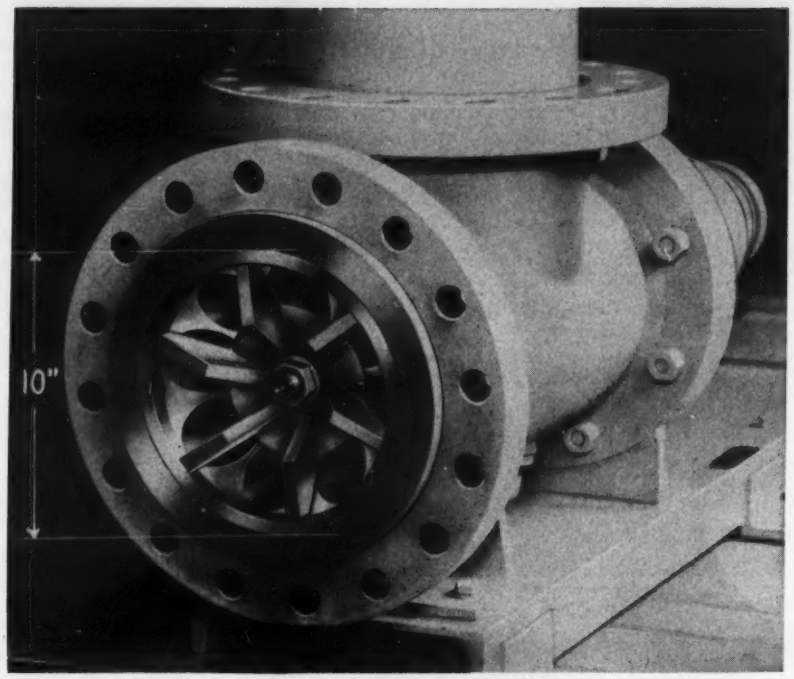
Saves space. No tank. Unit can often be installed in place of elbow in present piping.

High efficiency. A high percentage of energy is converted to local high-shear action in contrast to propellor or disc type mixers where a large proportion of energy is expended in movement of a large volume of material in the mixing vessel.

Non-foaming. No air present. Product receives intense shear without foam.

Process flexibility. Material can be run through once or recirculated. Units can be used in series or parallel. Retention time can be varied by governing the size of outlet opening or feed rate.

Acts as pump. Mixer generally creates sufficient pressure to move material to next process unit.



Eppenbach 10″ Pipeline Homogenizer with inlet flange removed.

Model Sizes	*Motor hp*	*Rotor rpm*	*Capacity in gpm (2)*
2″	½	7200(1)	30
3″	2	3550	70
4″	5	3550	150
5″	10	3550	200
6″	15	3550	250
10″	30-60	1750	1300

1—Belt-driven. Other models also available with belt-driven rotors for higher rotor speeds.

2—For comparative purposes only. Figures show approximate gpm of water pumped by unit against a 10 ft. head. Actual mixing volume for any unit may range from 50 to 200% of figures given.

Specifications

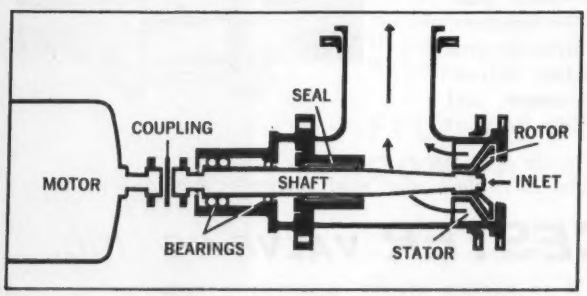
Operating pressures. Std. — 100 psi. Units for 300 psig have been supplied.

Seals. Liquid-flushed double mechanical type.

Metals. As required. A standard metal for rotor and stator is 17-4 precipitation hardened stainless steel with other contact metals of 316 S.S.

Motors. Standard—110 or 220V single phase or 220/440V 3 ph, 60c. Other motors on request.

Mounting. Portable or stationary — in any position from horizontal to vertical.



Left: Eppenbach 10″ Pipeline Homogenizer. Note simplicity of design for easy maintenance.

Rental units

Eppenbach Pipeline Homogenizers, in sizes up to 5″, can be rented for lab or pilot-plant operation to determine proper sizes, speed, etc.

GIFFORD-WOOD CO.

Dept. CP10, Eppenbach Division, Hudson, N. Y.

Eppenbach colloid mills, homogenizers, homogenizer-mixers . . . for laboratory, pilot plant and large-scale production.

Check 1017 opposite last page.

PEOPLE

From page 14

company's Texas City plant. He will be responsible also for integrating Texas City and Chocolate Bayou ethylene operations.

Frank G. Fanning has joined Millmaster Chemical Corporation as vice president of the Fanning Chemical Division.

George H. Hallenbeck, in charge of Swift & Company's soap and soap chemical operations since 1954, is manager of the company's new Chemicals for Industry Department. The department includes the company's general soap and soap chemicals department and the technical products division, processors of fatty acids and other fat-based chemicals. Hallenbeck will supervise production, promotion and sales.

Implementing a newly planned expansion program, Catalysts and Chemicals Inc., Louisville, Ky., has shifted **Paul Huber** from manager of manufacturing to chief engineer to handle the installation of new equipment and buildings. **Dr. Wilson Barnes,** previously with Corhart Refractories Co., is now manager of manufacturing.

Stephen Basarab has been appointed plant manager of Metal & Thermit Corporation's detinning plant at Carteret, N.J.

Otis W. Fortner, has been appointed works manager of The Borden Chemical Company's vinyl acetate and methanol plants currently being constructed at Geismar, Louisiana.

Richard H. Braunlich is now manager of R&D for American Viscose Corporation's Fibers Division.

Formerly production superintendent of the Buffalo, N.Y., plant of Becco Chemical Division of FMC Corporation, **Roger L. Sullivan** has been appointed manager of Becco's multi-million dollar hydrogen peroxide plant at South Charleston, W. Va.

CP editor off for Europe

. . . speaks before Societe de Chimie Industrielle

John Vaaler, chairman of the editorial board of CHEMICAL PROCESSING, is now overseas making a swing across the Continent.

First stop on his scheduled Western European tour was Bordeaux, France, in order to attend the 33rd Congrès International de Chimie Industrielle, September 28-October 8.

Invited to speak on the American Day program, he discussed the value of business publications as a marketing tool.

Vaaler also attended the International Congress on Control of Water Pollution, which was held in Basel, Switzerland. Since many European nations have been recently placing greater emphasis on anti-pollution measures as a means of safe guarding their water supply, this meeting is held to be particularly significant.

Throughout his trip, John will be interviewing top technical executives of major chemical companies on the Continent. He will be sizing up trends in European technology and processing techniques, and evaluating them as to potential application in the U. S.

Watch future issues of CHEMICAL PROCESSING* for the CP editorial staff member's first-hand reports on European pollution control and other subjects of importance to operating management.

* See this issue, page 38 and September CP, page 29, for on-the-spot reports on the ACHEMA Chemical Engineering Congress held earlier this year in Frankfort (Main), Germany.

letters from readers

Free-engineering editorial draws PEMA fire, Lab Council praise

The following two letters were received in comment on the "Over the Editor's Shoulder" column on p. 5 of the July CP, entitled, "Equipment makers or consulting firms?"

Gentlemen:

I wish to take this opportunity to congratulate you for your editorial in the July, 1961 CHEMICAL PROCESSING.

The problem of "Free-Engineering Service" and "Free-Laboratory Service" is a major problem in industry. Aside from the rather obvious truth, that such services are never free, but must be paid for either in increased charges for the products or in inferior merchandise, the consumer always loses in the long run when the so-called free services are utilized.

No technical personnel, no matter how qualified, can be truly unbiased when tied to a sales program as "Free-Engineering Service" and "Free-Laboratory Service" of necessity must be.

The American Council of Independent Laboratories, Inc. is an association of independent laboratories devoted to maintaining high standards and unbiased professional and technical service. We back you wholeheartedly in this editorial.

CHARLES C. WRIGHT
Chairman
Western Division
American Council of
Independent Laboratories, Inc.
Long Beach, Calif.

Sirs:

The Process Equipment Manufacturers Association is indebted to CHEMICAL PROCESSING for its very fine article on our new Association in your May issue. ("Changes loom in industry which supplies your processing equipment," p. 38).

However, the suggestion made in your (editorial) column (in July), namely, "bids would consist primarily of price information with only sketchy outlines on the physical set-ups" will, we feel sure, not be acceptable to many company engineering staffs or consultants and certainly not to most manufacturers of process equipment.

The staff of a process equipment manufacturer is composed of specialists in their particular line. Each wants to convince the buyer that he is the best in his particular field. He must have complete knowledge of the buyer's requirements so that he can offer a complete package — not sketchy outlines — but something convincing.

He brings to the problem his experience with many hundreds of users of his equipment, and this experience is very difficult for a chemical company or many consultants to have to the same degree.

The equipment manufacturers must be, and always have been, very much involved in the processing problems. In marrying any given machinery with material, the proper application must be worked out by the people who have an intimate knowledge of both the behavior of the machine and the behavior of the material.

If the chemical company engineers or their consultants had this knowledge, certainly they could do the job at whatever cost would be involved. I think the major point is that they do not have this overall knowledge and therefore, of necessity, the equipment people have always had to step in and play a great role in the proper combining of the materials and the machines in order to work out the process effectively.

As a result of this absolute necessity, many equipment

companies already perform consulting functions for a fee. Many, as we know, do an excessive amount of this type of work for which they are not paid, thus reducing their profits.

Certainly if the chemical companies would shoulder the total cost, as you suggest, of this type of consulting work and if they could do it cheaper by using their own men or outside pure consultants, they should do so. If they cannot do it cheaper, then, in effect, they employ the machinery designers to perform this necessary job.

As a matter of fact, in recent years there has been quite a trend toward companies who, as a matter of policy, hire the machinery design people to perform some of those process and engineering functions that normally they would do themselves. All progressive companies, to a certain extent, willingly pay for these services rendered by the equipment companies.

In the above discussion I am, of course, talking about the basic process equipment which represents a fairly small portion of the total capital dollar spent by the chemical industry. I am not talking about that great percentage of the capital dollar that goes for such things as brick and mortar and pipes and valves and tanks and motors and electrical equipment and wash basins and floor titles, etc, etc.

J. D. Hitch Jr.
President
Process Equipment
Manufacturers Association
New York

Engineering vs science; not a new conflict

Sirs:

Your article on "The chemical-engineering scientist and how he got that way" (August CP, p. 25) is excellent.

Your article following as it does S. David Pursglove's article "Here's how you can use EVOP" (August CP, p. 23) may encourage your readers to explore evolutionary opera-

tion techniques with a three dimensional information board to study "The Engineering Factor," "The Science Factor," and "The Time Factor," which enter into the education, training, and experience of all engineers. (For the time being "the humanistic-social factor" in the undergraduate education of an engineer seems to be pretty well agreed within fairly narrow limits) . . .

About ten years ago I wrote a paper on "Backgrounds of Engineering Education" in connection with the Centennial of the American Society of Civil Engineers. Without referring to the background notes for that paper, I can't be fully sure — but I think it was about 1870 that a controversy involving "engineering" and "science" was pretty hot also.

Certainly the 1870 controversy was not the first — and the discussions of the 1960's will not be the last among thoughtful and responsible persons dealing with "engineers," "scientists," or any combination of "engineers and scientists" from sub-freshmen to post-doctorates.

Yours was a good article in a good issue of CHEMICAL PROCESSING.

F. T. MAVIS
Dean
College of Engineering
Glen L. Martin Institute
of Technology
University of Maryland
College Park, Md.

Watching Washington

Turpentine's 'poison' label erased through budget pressure on FDA

WHAT'S IN A WORD? — Turpentine is not a "poison," it is a "dangerous substance." The difference between the two apparently means reinstatement in the Food and Drug Administration budget of $1.5 million . . . dropped mostly through the efforts of Senators from turpentine-producing states.

The Senate Appropriations Committee had dropped $1.5 million from that portion of FDA's budget devoted to enforcing the new hazardous-substances labeling act. The Committee's only official comment was that "administrative procedures adopted to carry out new responsibilities are questionable."

However, Southern members of the Committee had earlier joined other turpentine-state Senators and Representatives in trying to persuade FDA not to require the poison label and skull and crossbones on turpentine.

Naval-stores-industry representatives had persuaded several-score Congressmen, including 14 Senators, to hold a pre-hearing meeting with FDA officials. So strong was the pressure that even Health, Education, and Welfare Secretary Abraham Ribicoff turned up.

About a week later the Senate Appropriations Committee cut FDA's budget. At that point, Food and Drug Commissioner George P. Larrick set up an independent committee of consultants to consider the turpentine issue. The group ruled that the toxicity and frequency of accidents should place turpentine in the "danger" category rather than in the "poison" class.

New turpentine labels will be required to display the word "danger" prominently and carry the admonition, "Keep out of the reach of children." Some other substances listed as dangerous are kerosene and other petroleum distillates, some cleaning aids, solvents and bleaches.

The only substances required to be labeled poison under the new hazardous substances labeling act are carbon tetrachloride and methyl alcohol. These labels must carry the word, "poison," the skull and crossbones, and specific warnings. The milder "warning" class includes ethylene and diethylene glycols.

Deputy FDA Commissioner John L. Harvey earlier had expressed surprise at industry's reaction to the new act and the proposed implementing regulations. Even before turpentine became a public issue, Harvey told an American Bar Association meeting:

"I have been most impressed with the volume and to some extent the heat of the objections raised. It has distressed me that so many representatives of industry fail or refuse to recognize the sincerity of the Administration in treating the proposed regulations as tentative proposals with every intention of giving the fullest possible consideration to the objections raised."

KO PUNCH AT DRUG MAKERS — The pharmaceutical segment of the chemical industry can expect to come under a new kind of attack as a result of the recent Government indictment on price-fixing charges of three major antibiotics producers. Publicity will center on patent monopolization and restraints against possible better drugs. The industry can expect to enter an era of charges and rumors.

The charges — against Chas. Pfizer & Co., Inc.; American Cyanamid Co.; Bristol-Myers Co.; and their three top offi-

WASHINGTON NEWS

cers — contained this statement as an indication of patent monopolization:

"Pfizer and Cyanamid knew that tetracycline was directly competitive with terramycin and aureomycin and represented a threat to the continuation of their dominant positions and unreasonably high profits. Pfizer and Cyanamid also knew that unless one of them could obtain a patent on tetracycline, prices of broad-spectrum antibiotic products could become competitive."

All three firms were charged in the indictment with misleading the Patent Office in securing the tetracycline patent. Attorney General Robert F. Kennedy says that the price-fixing conspiracy between Pfizer and Cyanamid began at the same time that all three firms entered into the alleged patent conspiracy, November 1953.

Earlier price-fixing charges against major drug firms brought wide-spread, popular outcries. However, the new charges of patent conspiracies and possible suppression of better drugs are expected to lead to even more far-reaching publicity.

The indictment specifically charged that the activities of the three firms — and two alleged co-conspirators, The Upjohn Company and Olin-Mathieson Chemical Corp. (parent of E. R. Squibb and Sons) — were such that other companies were kept from marketing better drugs and research was hindered. This sort of charge has far more political mileage than does a simple attack on high prices.

EVERYBODY'S A WINNER — Your company now can be reimbursed for the cost of preparing a bid for work applicable to the Atomic Energy Commission's programs. Firms also can be reimbursed for incentive compensation.

The AEC, under new regulations, will reimburse such expenditures up to 1% of the direct material and labor costs of the contract. Reimbursement for such preparation will be made for both successful and unsuccessful bids.

RADIOISOTOPE MIX-UP — The Atomic Energy Commission plans to permit additional means of determining permissible concentration limits for mixtures of radioisotopes contained in effluents released into water or the atmosphere. Present limits are not comprehensive enough, says AEC, to provide limits for all mixtures of radioisotopes encountered in practice.

The AEC proposes to amend Part 20 of its regulations to provide additional means for deriving a concentration limit where:

1) The identity of each radioisotope in the mixture is known, but the concentration of each is not known.

2) The identity of each isotope is not known, but where it can be demonstrated by assay or the process of elimination that radioisotopes other than those now specified in the note to Appendix B of the regulation are not present to any significant extent.

The concentration limit for any mixture would be based on the radioisotope which has the lowest concentration limit now specified in the regulation. The proposal also sets up criteria for determining conditions under which isotopes would be considered as not present in a mixture. ■

"He planned a six week program on his problem, and his first experiment solved it."

Henry Gaines Goodman, Union Carbide Chemicals

conventions and exhibits

Oct. 16-19. Chemical Section, National Safety Congress, LaSalle hotel, Chicago, Ill.

Oct. 18-19. Commercial Chemical Development Association, Palmer House, Chicago, Ill.

Oct. 18-20. 23rd Annual National Packaging Forum, Packaging Institute, Biltmore hotel, New York City.

Oct. 19-20. National Conference on Industrial Hydraulics, Sherman hotel, Chicago, Ill.

Oct. 19-21. Fall Meeting, National Society of Professional Engineers, Hotel Roanoke, Roanoke, Va.

Oct. 23-24. American Coke & Coal Chemicals Institute, Annual Meeting, Greenbrier, White Sulphur Springs, W. Va.

Oct. 23-27. National Metal Congress and Show, American Society for Metals, Cobo Hall, Detroit, Mich.

Oct. 24-27. National Association of Corrosion Engineers, Conference and Exhibition, Shamrock hotel, Houston, Tex.

Oct. 25-26. Computer Applications Symposium, Armour Research Foundation, Morrison hotel, Chicago, Ill.

Oct. 26-27. Pharmaceutical Manufacturers Association, Production and Engineering Section, Seaview Country Club, Absecon, N.J.

Oct. 29-31. Fall Meeting, Fluid Controls Institute, Hotel Hershey, Hershey, Pa.

Oct. 29-*Nov.* 1. National Agricultural Chemicals Association, Annual Meeting, Homestead, Hot Springs, Pa.

Oct. 30-*Nov.* 1. 74th Annual Meeting, National Paint, Varnish and Lacquer Association, Statler and Mayflower hotels, Washington, D.C.

To page 26

THAT'S INTERESTING

Suit sizes pinned down

So far as boys' clothes are concerned Uncle Sam can now tell you just exactly what is a "slim" boy, a "husky" one and a "robust" one.

The U.S. Department of Commerce's Commodity Standards Division did the job at the request of manufacturers and distributors. The standard is set up in terms of height and weight.

Here's an example. A boy 58″ tall is a size "12." If he weighs 77 lb, he is a "Slim 12;" if he weighs 107 lb, he is a "Robust 12."

Engineers' salaries up

A survey of over 24,000 engineers, conducted by the National Society of Professional Engineers, shows median income of respondents is at a new high of $10,660—an increase of 6.6% since 1958.

For more information on product at right, specify 1028 see information request blank opposite last page.

conventions and exhibits

From page 24

Oct. 30-*Nov.* 1. American Oil Chemists' Society, Fall Meeting, Pick-Congress hotel, Chicago, Ill.

Oct. 31-*Nov.* 4. Federation of Societies for Paint Technology, 39th Annual Meeting and 26th Paint Industries Show, Shoreham hotel, Washington, D.C.

Nov. 1-3. Technical Association of the Pulp and Paper Industry, Alkaline Pulping Conference, Rice hotel, Houston, Tex.

Nov. 6-10. Joint with AIF and Atom Fair, American Nuclear Society, Conrad Hilton hotel, Chicago, Ill.

Nov. 7-10. Packaging Machinery Manufacturers Institute, Exhibition, Cobo Hall, Detroit, Mich.

Nov. 13-15. American Petroleum Institute, 41st Annual Meeting, Conrad Hilton hotel, Chicago, Ill.

Nov. 17-18. The Chemical and the Food and Allied Industries Division of the American Society for Quality Control jointly sponsoring course in EVOP Programming, Pick-Congress hotel, Chicago, Ill.

Nov. 21. Manufacturing Chemists' Association, Semi-annual Meeting, New York, N.Y.

Nov. 27-*Dec.* 1. 28th Exposition of Chemical Industries, Coliseum, New York City.

Dec. 3-6. 54th Annual Meeting, American Institute of Chemical Engineers, Hotel Commodore, New York, N.Y.

Dec. 4-6. 48th Annual Meeting, Chemical Specialties Manufacturers Association, Roosevelt hotel, New York, N.Y.

Dec. 7. Annual Meeting and Dinner, Synthetic Organic Chemical Manufacturers Association, Hotel Roosevelt, New York, N.Y.

OPERATING MANAGEMENT'S OWN MAGAZINE

October 1961

CHEMICAL PROCESSING

Who should foot the bill for 'equipment suitability' tests?

CP check of equipment suppliers and their chemical-company prospects turns up some agreement but much divergence of opinion on charges, rental credit, test procedures and secrecy clauses. Here are points to ponder when you next tackle a joint program of pre-sale trials of test processing equipment

By **JOHN C. VAALER,** Chairman
Editorial Board

TODAY'S continuing program of research and development in the chemical processing industries brings forth many new problems. One facet of this program is that of determining how and with what kind of equipment a given chemical should be processed.

Suitability of Equipment Has To Be Determined

In the case of a new chemical, never before commercially produced, new procedures will often be involved which will call for testing of processing equipment to determine its suitability. The same is true, although perhaps to a somewhat lesser extent, when changes in existing commercial processes are contemplated.

Variety of Test Factors Require Evaluation

Ticklish situations are frequently encountered in the use of test processing equipment, particularly as they relate to the arrangements under which the potential user avails himself of such equipment from the manufacturer. Even the seemingly simple decision of whether to run the tests in the plant of the equipment manufacturer or in that of the potential user can be complicated by some not so obvious factors.

It has been evident that both user and manufacturer policies regarding the use of such test equipment have varied considerably. Recognizing this, CHEMICAL PROCESSING has just surveyed a number of major chemical companies, as well as equipment manufacturers, as to the arrangements they prefer for running such trials.

Here is what CP's editors found in regard to policies as to charges for such tests; who should run them and where; purchase obligations; protection of secret data, and related questions. Several aspects of the subject are emotionally

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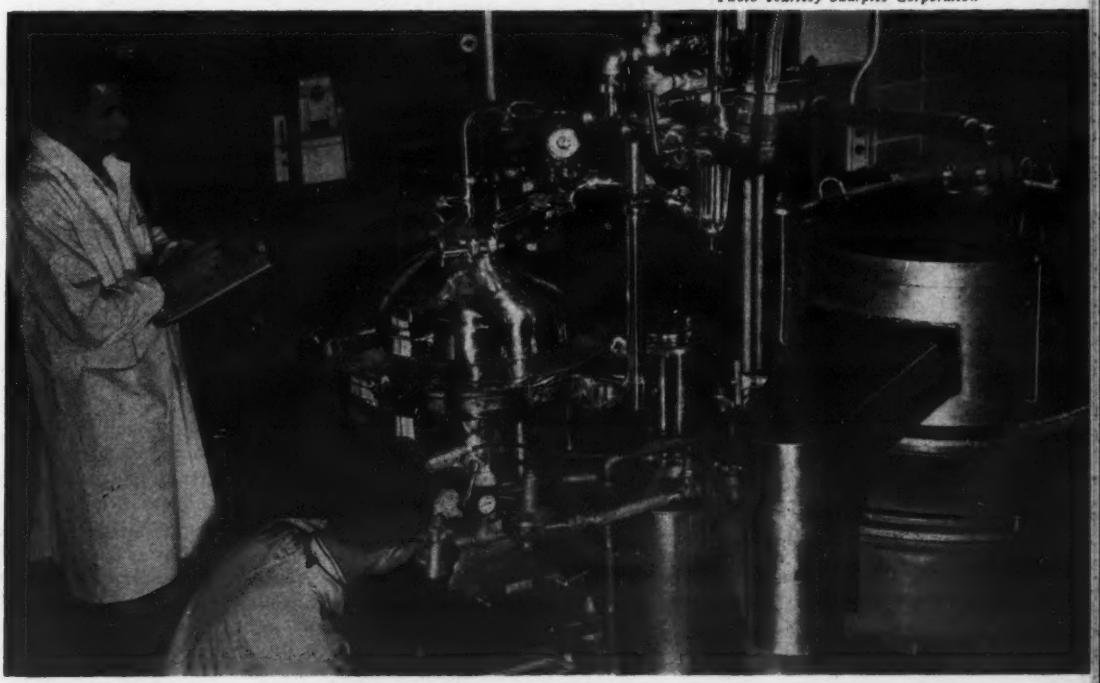
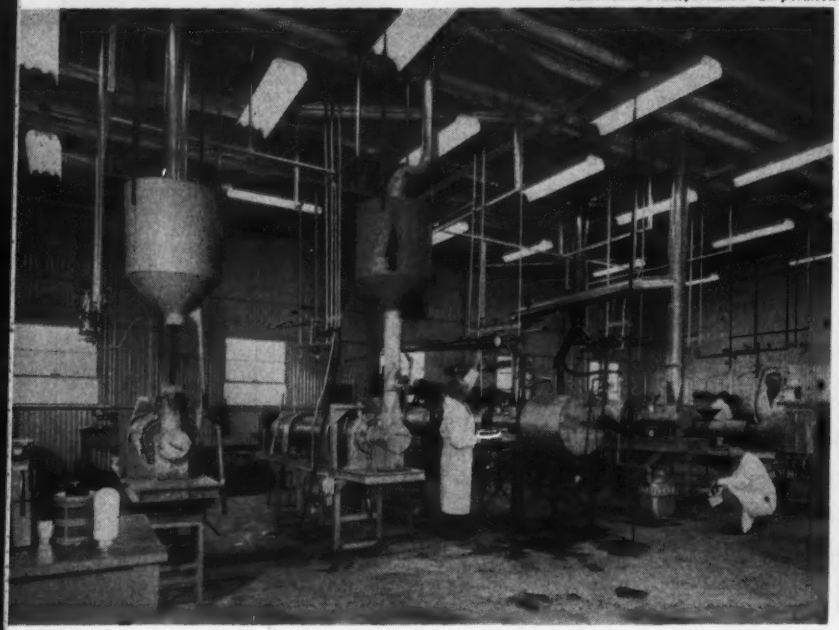
Photo courtesy Sharples Corporation



***Well-trained** technicians are a "must" in running test equipment*

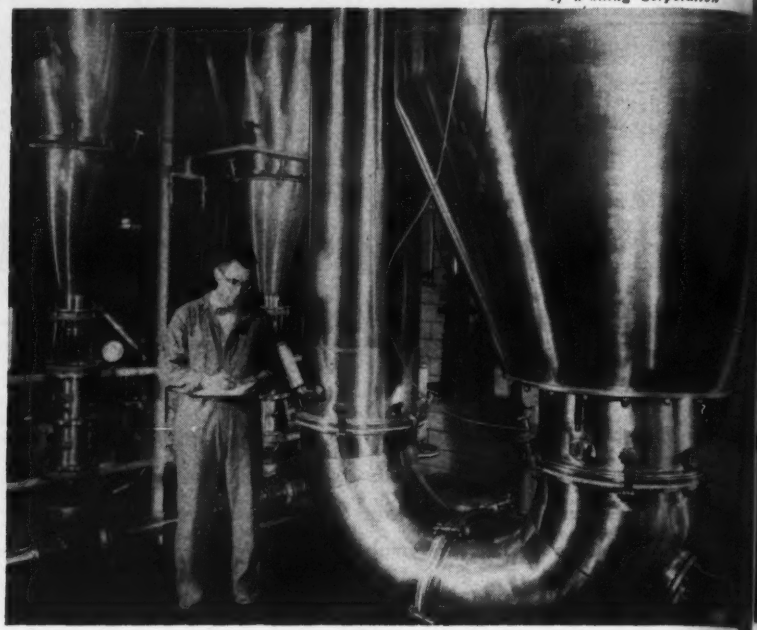
'Equipment suitability' tests . . . *From preceding page*

Photo courtesy Louisville Dryer Division, General American Transportation Corporation



***In some** test operations preliminary runs are made on pilot-plant-size dryers which permit later scale-up to the commercial operations . . .*

Photo courtesy Swenson Evaporator Company, Div. of Whiting Corporation



. . . In other tests, full scale production runs are performed on commercial-size equipment, such as these spray dryers

super-charged. Hence, specific sources of the information have been kept anonymous.

Should the equipment manufacturer charge for running tests?

Most of the equipment manufacturers and potential users surveyed favor some kind of payment for the testing work. But even in those cases where the service is offered "free," it is customary to charge transportation costs when test equipment is shipped to the user's plant.

It is often the practice for simple tests to be run at no charge by the same manufacturer who will ask payment for a more complex run. And it is not uncommon for user and manufacturer to share test expense where there is some uncertainty as to whether the equipment will do the job.

If an equipment manufacturer is assured further use of test results stemming from tests made on a new chemical product in his plant, he may waive test charges.

Most manufacturers make a differentiation between field and laboratory tests in establishing charges. One manufacturer breaks things down into "sales tests" and "research tests." The former is, at most, only partially financed by the potential user, while the latter is fully charged to him.

Equipment manufacturers are quick to point out that charges are made not as a profit-making operation but to recover costs incurred in cleaning, reconditioning and refitting, and to cover depreciation of the test equipment. Time-based rental charges tend to speed up a test program, they say.

Even so, some chemical-plant men still feel that there is good reason for them not to pay for test programs.

One such man, who has a policy of not paying for such testing, considers a "no charge" arrangement simply as a sales tool in the equipment-maker's marketing program. Another draws the line between testing built around a new process or chemical product and a simple replacement of equipment. He will not pay for the latter, but will pay for the former ("to assure securing of best equipment for new application").

Who should run the tests?

These test runs are usually a joint effort. Therefore, it is not surprising that both the equipment manufacturer and user like to have the manufacturer's representative present to observe results and offer suggestions in operation that may improve the quality of the test. Nor is it surprising that both prefer that the user's engineers be in on the testing, too. In fact, many equipment manufacturers insist on this.

Good Supervision Essential

Obviously, in the manufacturer's laboratory it is relatively easy to have a technically qualified man supervise operations. However, this is not as easy in the field; nevertheless, the consensus is that this is a "must." Highly qualified manufacturers' engineers can guide user personnel and usually shorten the time to reach objectives.

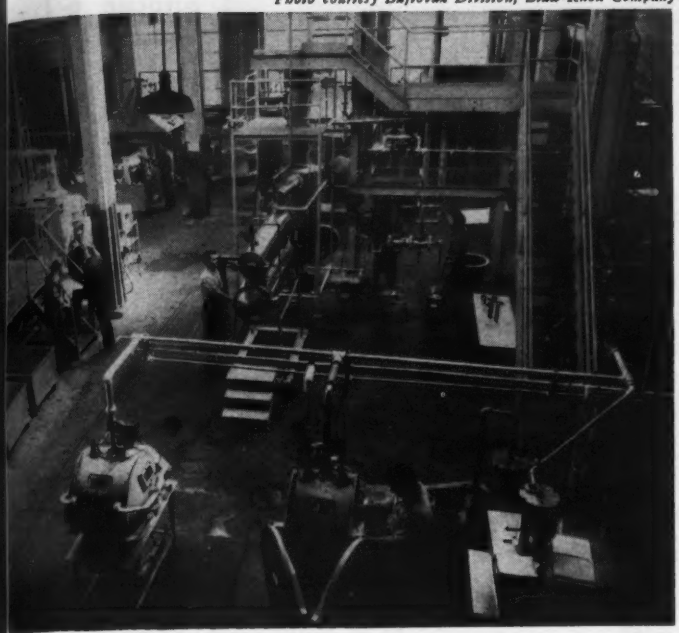
In some instances, it is recommended that test work be started by the manufacturer's engineer, who would also provide a schedule and a list of data to be obtained, so that user personnel may complete the test on their own. A well-defined program of evaluation by the manufacturer, at the early stage, will enable the prospective user to obtain proper technical data for subsequent analysis. Equipment makers further claim that the presence of the manufacturer's engineer, when the test data are taken in the field, permits interpretation for the design of the commercial equipment to follow.

Frequently, supplier spokesmen decry the fact that their engineers are not permitted to view tests when run in the user's plant. Here, perhaps, the phobia of secrecy is carried too far and limits the manufacturer in making proper recommendations.

Where should tests be run?

There is no finely drawn

Photo courtesy Buflovak Division, Blaw-Knox Company



***Many equipment** manufacturers have extensive test facilities, with process equipment always set up and ready to go*

answer to this question. Point of test operations must be analyzed for each condition, replies revealed.

Generally, users would *like* to have tests run at their own plants, while the equipment makers prefer that tests be run at their operations.

It is difficult at times to accede to this user-preference since the limitations of equipment size very often prevent this. Accordingly, users generally agree that in those cases it is advisable to run tests at the vendor's rather than on their own property. The consensus is that as long as the vendor has equipment set up, there should not be much expense involved in getting it ready for a test run. It is also an advantage to have equipment and instrumentation available for handling counting, timing and generally gathering test data.

Primary reason for the equipment maker's preference in running tests at his plant is that he can be sure the equipment is under the guidance and operation of trained engineers and technicians. This may be especially true for preliminary testing. Furthermore, a wider latitude of testing is available where complete lines of equipment are ready for test operations.

Some equipment spokesmen expressed preference for tests being run at the prospect's operations. They point out that such tests are more comprehensive and conclusive because of the greater quantity of material available. They add that conditions can be better simulated and that the time element is less critical. Study of day-to-day variations in the product, as the tests are carried on over a longer period of time, will also bring about more conclusive results, they conclude.

Occasionally, though, when tests are run at the user's operations, free access to plant operations and related processes may not be made available to the equipment manufacturer's engineers. This can hamper them from doing an effective, intelligent job. Hence, in such situations it might be better to run these tests at the equipment manufacturer's research center.

There are cases, however, when it is mandatory for test operations to be carried on in the user's plant. When the nature of the material to be tested is such that it cannot be shipped, those trials, obviously, must be made in the field. Too, if product degradation occurs in shipment of samples, those tests would also have to be run at the user-plant site.

Furthermore, when plant conditions cannot be duplicated in the equipment manufacturer's laboratory, this poses a limitation which prevents a laboratory test, and as a result the test would have to be made on the user's premises.

Should prospect feel obligated to buy after a successful test?

Undoubtedly this question is loaded. Emphatic "no's" were given by some users. Normally, they say, payment is made for the use of equipment on trial runs, and, therefore, the user should feel no obligation to purchase from the equipment vendor. But there appears little doubt that the vendor whose equipment performs well in a successful test will get special consideration.

In only a few cases does the manufacturer go along with the user's feeling that there is no obligation on the part of the prospect to buy after either a free test or after one where a charge has been made. Especially in instances where special designs or expensive adaptations of existing equipment have been made, the seller feels that the user has a moral obligation to buy.

Should rental charges apply against purchase price?

Most users hold to the belief that at least some of the equipment rental should be credited against the purchase price of commercial-size equipment. One user expects 50% of the rental to be applied against the purchase price. Another user feels that full rental charges should be credited against the purchase price, when these charges are appreciable.

The CP survey of equipment makers showed that, in several instances, full rental charges are credited when the user buys the *actual test equipment* that was installed. There are only a few instances in which the manufacturer does not offer some form of rental credit against the purchase price.

Credits for rental charges toward the purchase of equipment vary from manufacturer to manufacturer. In one case, the first month's rental is charged and the second month's rental may be credited toward purchase. Another manufacturer allows 100% of the first 60-day rental charge to be credited toward the purchase, 75% of the second 60-day rental charge, and 25% of an additional 30-day rental charge. No additional credit is given if rental equipment is used more than 150 days.

Typical equipment-rental rates, according to the CP survey, varied from $10 to $275 per day, depending upon the nature of the equipment. One manufacturer charges 5-10% per month of the value of the new equipment and credits a portion of this amount against purchase if made within six months after tests are completed.

Should the user require a secrecy agreement at the time of initial tests?

The nature of the product being tested is obviously a determining factor in the answer to this question. If the product is completely new and unique, the user generally requires the manufacturer to sign a secrecy agreement. In some cases, the user will rely on the integrity of the manufacturer to hold test data in complete confidence.

Other industry spokesmen commented that they would turn down any proposal for testing by a manufacturer who refused to sign a secrecy agreement.

Generally, equipment vendors are perfectly willing to

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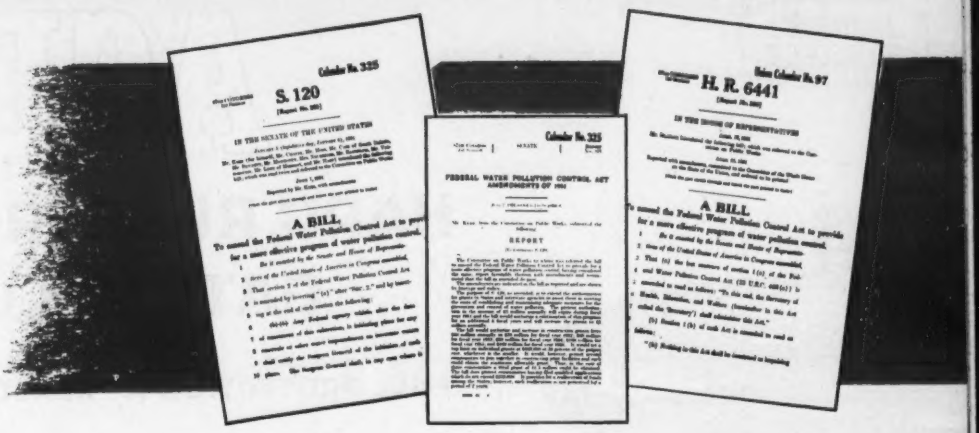
President Kennedy *evinces pleasure in affixing his signature to legislation which steps up government's drive against pollution of nation's rivers and lakes and helps assure U. S. of safe water supply. Present at signing in White House are (l. to r.) Sen. Francis Case (R., S. Bak.); Sen. Hugh Scott (R., Pa.); Rep. Frank Smith (D., Miss); and Rep. Charles Buckley (D., N. Y.)*

What the new w

Stronger — and longer — teeth in amended Federal water-pollution control law make it even more urgent CPI management maintain close liaison between plant and municipal, state and Federal agencies



water-pollution law means to you

THE KEEN INTEREST of the Congress and the Administration in water-pollution control and abatement is pointed up by the high priority given to amendments to the Federal Water Pollution Control Act. These amendments, signed into law by President Kennedy on July 20, were given legislative precedence over taxes, foreign aid and similar major measures.

The amendments are now law.

What do they mean to operating management?

At first review it would appear that the amendments do not have too much of a direct bearing on plant operations. An analysis of the significance of the legislation reveals, however, several areas which are of the broadest kind of long-term interest to chemical processing executives.

Two statements, one from industry and one from government, indicate the general unanimity with which the new amendments were greeted. General John E. Hull, USA (Ret.), president of the Manufacturing Chemists' Association, said:

"The law, as signed by the President, recognizes that despite the excellent efforts of the various water-pollution control centers throughout the country, there still remains a need for increased research to keep pace with economic and technological advances.

"In aiding communities to construct adequate treatment facilities, the law now provides for two or more communities to act jointly to construct such facilities. It also recognizes the primacy of local responsibility in providing effective pollution control.

CPI Spends $100 Million on Pollution Control in '60

"The chemical industry, which last year alone spent more than $100 million on water-pollution control and which has sponsored long-range pollution research projects through the MCA, is gratified that the new legislation supports state and interstate agency programs with which the industry has worked effectively in the past."

Across the city of Washington, Abraham Ribicoff, secretary of Health, Education and Welfare, was saying, "The new law provides for intensified research, inclusion of water-quality-control features in Federal planning and construction of reservoirs, extended and increased Federal financial assistance to States for operation of their water-pollution-control programs, heightened stimulation of waste-treatment-facilities construction by municipalities, and strengthened Federal enforcement procedures to abate serious pollution situations . . .

"This administration is firmly resolved to carry out the provisions of the amended Act to the fullest authorized extent so that progress toward our ultimate objective may be effectively accelerated."

Both General Hull and Secretary Ribicoff seem to feel that the amendments are progressive ones which will help assure the nation of an adequate, safe water supply.

Law's Provisions Analyzed

Taking the amendments one at a time as they appear in the law, this CHEMICAL PROCESSING-staff roundup will report the amendment and then offer comments based on interviews with members of the Congress, members of the Department of HEW concerned with administration of the law and industry representatives.

1 Government's Own Water-Pollution-Control Measures.

The law now provides that surveys or planning of any reservoir under Federal jurisdiction shall give consideration to storage for regulation of stream-flow for the purpose of water-quality control. The need for storage facilities shall be determined by the respective agencies with the advice of the Secretary of HEW. The storage facilities shall not serve as a substitute for adequate treatment or other methods of controlling waste at the source.

Comment: To the extent that storage and streamflow control grows, plants now encountering problems when the water level drops should have fewer difficulties. Stay in touch with reservoir building in your area to ascertain what the new storage facilities will mean to the local waterflow situation and how they may benefit you.

2 Field Demonstration and Research Facilities.

The Secretary of HEW has now been authorized to "establish, equip and maintain" field laboratory facilities in specific locations. The general locations are Northeast,

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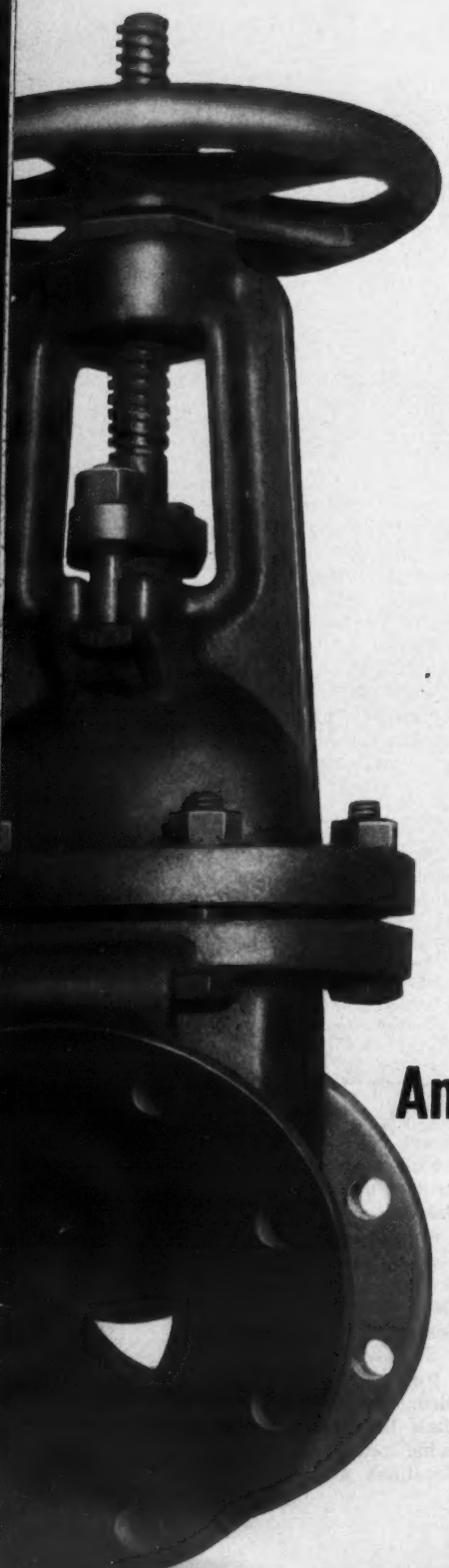
See "Watching Washington," September CP for the initial reaction of Gordon McCallum, Chief, Water Supply and Pollution Control Division of the U.S. Public Health Service. The HEW department is the most intimately concerned with the administration of the new law.



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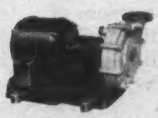
Rubber-lined steel tanks and special equipment. Also custom compounds for field application **Bul. CE-53.**

Rubber-lined steel pipe . . . combines strength of steel with chemical resistance of Ace Hard Rubber. **Bul. CE-51/52.**



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Hard Rubber pipe and fittings, including heat-resistant Tempron for handling hot corrosives. **Buls. CE-51/52 and 96.**

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OC

Titanium catches on in CPI

Shipments this year are running at four times the '59 rate, with more than 25 chemical processing plants currently making substantial titanium installations as advantage is taken of lower cost of metal, improved fabrication techniques and proved ability of Ti to cut costs in a variety of corrosive applications

By **GORDON WEYERMULLER,** Senior Associate Editor

THE LARGEST installation of titanium processing equipment ever made in the U. S. is currently under way in a petrochemical plant being built in West Texas. Heat exchangers, condensers, towers and pipe reactors will use from 15,000 to 30,000 lb of titanium, depending upon thicknesses selected.

More than two dozen other chemical processing plants are also currently making substantial installations of titanium equipment. During 1961 it is estimated that 300,000 lb of titanium will be used in the CPI, four times as much as in 1959.

Titanium is being utilized to an increasing extent for chemical applications for several reasons. First, the composite price for mill products has been cut in half during the last several years, currently running about $6 per lb. (See accompanying Table 1.)

The price has dropped as production has steadily risen and production has shot up as uses have been found for titanium in the aerospace program. For example, the capsules which carried two American astronauts 115 miles high each contained 600 lb of titanium.

Also, with a number of improved fabricating techniques, cost of completed titanium equipment is lower. Hence, far from being expensive, titanium equipment is proving to be the most economical material available for a considerable number of corrosive applications, if operating and maintenance costs are considered.

For example, one 49" titanium fan exhausting gases containing wet hydrochloric acid, ferric chloride and cupric chloride is saving a plant $57,000 a year in downtime, labor

To next page

TABLE 1 **Price And Production Of Titanium Mill Products**

Year	Composite Price per lb	Total Shipments in lb	CPI Shipments in lb
1955	$13.90	3,800,000	10,000
1956	11.75	10,200,000	10,000
1957	10.55	11,200,000	25,000
1958	8.95	5,200,000*	75,000
1959	7.25	6,400,000	75,000
1960	7.00	10,000,000	200,000
1961 Est.	6.00	10,700,000	300,000
1965 Est.	5.00	15,000,000	600,000

* Effect of "titanium recession" when U. S. Government cancelled contracts and shipments dropped precipitously.

Titanium catches on *From preceding page*

and materials. The titanium fan and housing cost $17,000.

The most significant breakthrough in fabrication is the use of welding techniques that eliminate the former method which required "welding in a box," or an enclosed chamber filled with inert gas. With present procedure, only local shielding and backup plates are required, with a stream of argon being played continuously around the welding area.

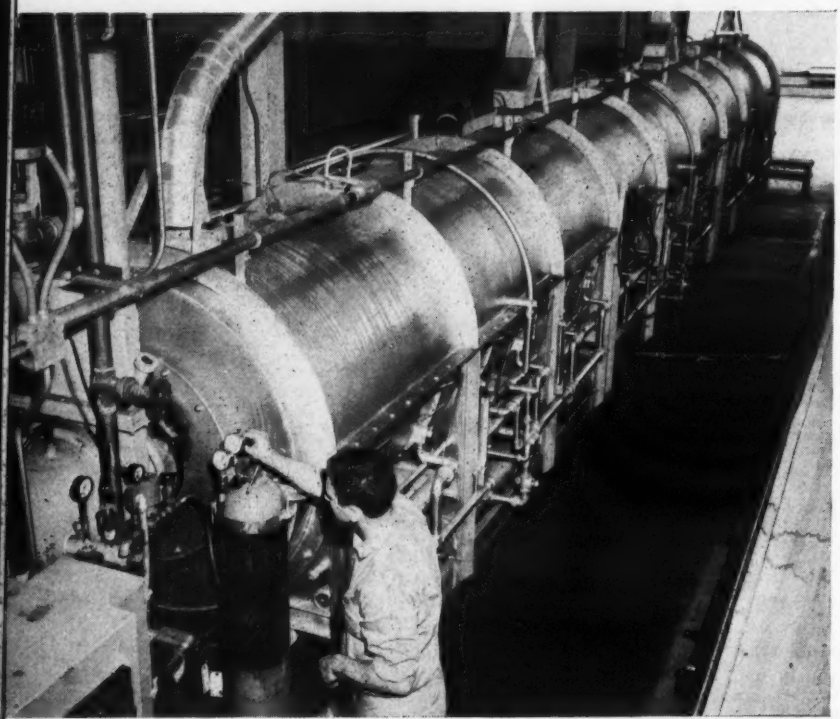
This technique, which often approaches "open-air" welding, has been found to be quite suitable for use in fabricating chemical processing equipment. It not only cuts costs but permits fabrication of larger-diameter vessels.

Another major fabricating development is the vanadium insert technique, which permits the welding of titanium to steel, a method devised by Titanium Metals Corporation of America (TMCA).

Chicago Bridge & Iron, Lukens Steel and Bridgeport Brass are offering titanium-clad steel, which can be used to advantage in certain cases. Pfaudler reports that titanium-clad steel will, when fully developed, open up high-pressure applications in reactor-type vessels. When this is achieved, high vacuum will also be applicable and a jacket can be used for heat transfer.

Vessels for light pressures of 50-75 psi, as yet, are usually more expensive when made of titanium-clad than if solid titanium is used due to greater fabrication costs for the clad.

Economy of clad comes into play at the higher pressures because of the greater overall thickness of metal required. Metal cost would be considerable if all of this thickness had to be titanium. Hence, the advantage of a thin sheet of titanium with a heavy carbon steel backing for high-pressure applications becomes evident. Thickness of titanium portion of clad for a high-pressure vessel usually need not be any greater than that for a low-pressure vessel.



Vacuum annealer, 135' long, used at the Special Metals Plant of Wolverine Tube, Division of Calumet & Hecla, Inc., Inkster, Michigan, to produce contamination-free, seamless, titanium tube in lengths up to 35'. Unit can be reduced from atmospheric pressure to less than 1/10th micron in approximately 12 minutes

Explosive Forming Could Prove Valuable

Explosive-forming of heads and use of the same technique for lining pipe is a new development that may prove valuable. Chicago Bridge & Iron has done some work in lining pipe with the explosive-pressure method.

Gray Tool Company is quoting firm prices on titanium-lined pipe made by either the explosive or hydrostatic pressure method and has under development titanium-lined fittings. The company has perfected a simplified spooling system, in which fabricated pipe can be made in standard flange design, providing a sealing surface similar to that of a Van Stone joint.

Titanium castings have become available, with Oregon Metallurgical producing them on a regular basis. TMCA recently developed a method for casting small parts in which permanent molds are used. The procedure will reduce mold costs that must be incorporated into the price of pump housings and sleeves, impellers, valve bodies and fittings.

Wolverine Tube recently developed finned titanium tube which combines the corrosion resistance of titanium with the improved heat transfer furnished by fins. The company has a special annealing unit which is a key part of the production operation.

Union Carbide Metals has broadened the corrosion resistance of titanium by the addition of 0.15% of palladium. Pure titanium is practically inert to oxidizing conditions but is not suitable for reducing conditions. The addition of palladium extends corrosion resistance into the reducing range. The alloy is useful in a service which is oxidizing most of the time but occasionally laps over into the reducing range.

The fact that fabricators have become aware of improvement in the quality of titanium materials, including plates, sheets, bars and tubing, has contributed to a more extensive employment of the metal.

In addition to lower cost of titanium and technical advances, another reason for the lower price of titanium equipment is the increased familiarity of fabricators with titanium and experience they have gained in welding and other fabrication methods.

Services Suitable For Titanium

An added factor which has resulted in increased use of titanium in the CPI is the steadily increasing familiarity of chemical operating management with the metal and its outstanding performance in certain services.

In general, titanium is used for five principal services: 1) inhibited sulfuric acid; 2) chlorine and chlorine compounds; 3) nitric acid; 4) petrochemicals; and 5) anodizing and plating. While the largest quantity of titanium equipment is now used with inhibited sulfuric acid, it is expected that the number one application will become chlorine and chlorine compounds.

Installations Under Way In Many Plants

Titanium subjected to inhibited sulfuric acid is frequently used in ore-processing operations as well as in other types of plants. A large zinc company recently placed an

order for six titanium heating coils which will use 1200′ of 2″-OD titanium tube. Coils are for a step in production of titanium dioxide pigment. A lined tank is also under consideration. The Sayreville, N.J., plant of National Lead just purchased three more titanium bayonet tubes and four digestion baskets to add to a number they already had.

Little more than a year ago only 500 lb of titanium was in service in the chlorine industry, this being at Stauffer. Since that time there has been a ten-fold increase. Ten titanium-tubed chlorine coolers or heat exchangers are currently being installed in three of the major chemical companies. Similar unit utilizing titanium coils are being considered at 11 plants manufacturing chlorine.

A large chemical plant near Houston is actively considering a compressor for chlorine service, a considerable portion of which will be solid titanium.

Titanium-lined chlorine manufacturing equipment is also picking up momentum. Two chlorine-caustic waste disposal tanks are being made for a company in Niagara Falls. A Louisiana plant plans to install a titanium-lined caustic scrubber. Another company will probably place three titanium-lined chlorine strippers in service.

Platinum-plated titanium anodes have been tested and appear to offer a number of advantages in chlorine production and in other electrolytic processes. Since the anodes are permanent, the disadvantages of anodes that deteriorate are overcome. As a result, purity of product is higher and power requirements are lower. At the same time, maintenance and replacement of anodes are decreased and the cell diaphragm is not clogged. In the cell, the titanium serves as the corrosion-resistant base and the platinum carries the current.

Aluminum-filled titanium lead-ins are also expected to play a key role in getting large amounts of current into the anodes.

In all of these chlorine applications, it should be continually re-emphasized that the chlorine must have ½% or more of water in order to be handled by titanium with nil corrosion rate.

Hot, concentrated nitric acid (except red fuming nitric acid) up to 250°F, is another service suitable for titanium. Four plants are currently installing titanium tube of ¾″ to 1″ OD for nitric acid service. One of these plants expects to use 14,500′ of 1″ tube for a heat exchanger. A plant in the Southeast is using 600 lb of titanium plate for a nitric acid reboiler.

Petrochemical Installations Being Made

In addition to the large petrochemical installation mentioned at the beginning of this article, other petrochemical installations are being made or considered. A petrochemical plant in the Midwest is having three titanium-clad autoclaves made for a process involving benzoic, acetic and phthalic acids. About 4000 lb of titanium will be used for these vessels. A small titanium-clad reactor for the same process is also being built, using the vanadium-interlayer technique.

Titanium is also being extensively used for scrap baskets and heat exchangers in anodizing and plating. Pulp and paper equipment is being fabricated of titanium for services such as chloride dioxide.

Among other applications, one plant is planning a titanium-lined fume stack. Another expects to install centrifuge with the basket and other key parts made of titanium. Six solid titanium separators for removing oil from corn mash are being considered at another plant. Solid titanium-spinning buckets are being tested in rayon production.

Tests have shown certain

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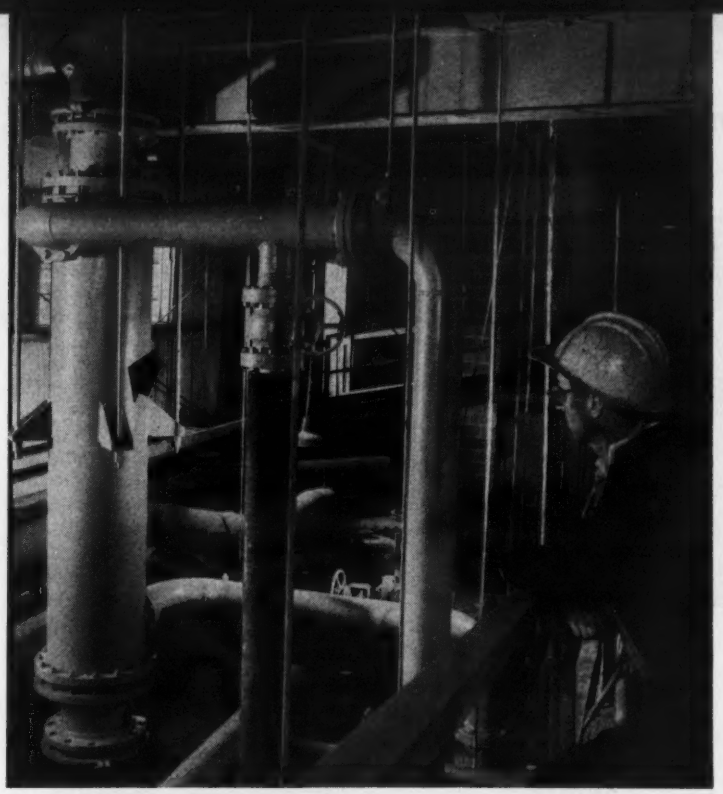
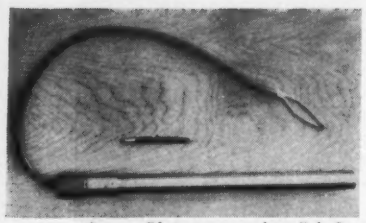


***Heat exchanger** used for cooling chlorine (arrow) has required no maintenance since being placed in operation at Stauffer Chemical two years ago. It handles 55 tons of wet chlorine per day. Cooler was fabricated by Pfaudler Company, using ¾″-OD seamless titanium tube furnished by Titanium Metals Corporation of America*

***Titanium tube** is being welded at Saffran Engineering in assembly which doubles as wind baffle and purge chamber. Argon protection is supplied through welding gun and clamp-shaped unit visible in center of canister. For less critical areas, such as tack welding of supports, open-air welding is used*

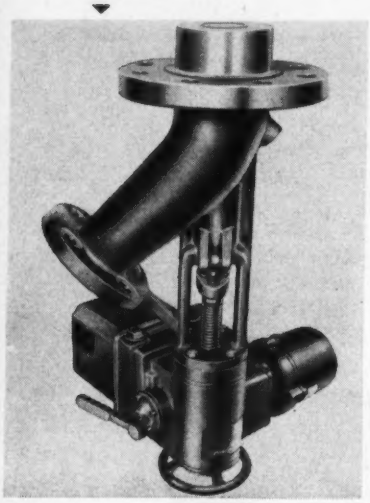
Photo courtesy TMCA

Titanium catches on in CPI *From preceding page*



▲ *Photo courtesy Astro-Fab, Inc.*
***Titanium-sheathed** immersion heater for highly corrosive media is non-breakable. Pencil gives idea of size*

***Motor-operated** flush-bottom tank valve made of titanium, presently on order from the Wm. Powell Company for use in a corrosive application*
▼



cellent toughness and weldability under cryogenic conditions at −423°F. Strength-density ratios of these alloys is outstanding.

For the operating manager who has a specific problem which may be solved by titanium, a list of the principal companies in titanium and their specialties is shown in Table 2. Information can be obtained from them by writing direct or checking designated key number.

As the need for titanium processing equipment has increased, fabricators have offered more services. Struthers Wells, Nooter and Pfaudler have all gone into the field rather extensively. Pfaudler has a special reactive metals fabrication department.

Astro-Fab is an interesting organization in that it started out a little over two years ago with one man with the avowed purpose of putting more titanium to work in the CPI. The company now has more than 40 employees and recently went to an extra shift in its operation.

Photo courtesy TMCA
***Checking dimensions** of titanium pump impeller cast through a new method based on use of permanent molds, which will cut cost of such castings*

Titanium competes with stainless steel, Hastelloy alloy C and non-metals, including glass, since it withstands the same corrosives in a number of instances. In such cases, economics play a major role in selection of construction material.

In contemplating such installations, the yearly cost should be considered, with due weight being given to maintenance and how soon a replacement will be needed with each material. Factors such as product purity may also enter into the decision. ■

TABLE 2 Principal Producers of Titanium

(Technical literature or information can be obtained from specific companies by checking designated number on Reader Service Slip opposite last page of this issue.)

SPONGE MANUFACTURERS

E. I. du Pont de Nemours & Co., Pigments Div., Wilmington, Del.	Check 1031
Reactive Metals, Inc., Niles, Ohio	Check 1032
Titanium Metals Corporation of America, New York, N. Y.	Check 1033
Union Carbide Metals Co., New York, N. Y.	Check 1034

MILL PRODUCTS PRODUCERS

Crucible Steel Company, Pittsburgh, Pa.	Check 1035
Harvey Aluminum, Inc., Torrance, Calif.	Check 1036
Reactive Metals, Inc., Niles, Ohio	Check 1037
Republic Steel Corporation, Cleveland, Ohio	Check 1038
Titanium Metals Corporation of America, New York, N. Y.	Check 1039
Oregon Metallurgical Company, Albany, Ore.	Check 1040

TITANIUM FABRICATORS

Titanium-clad Steel

Bridgeport Brass Co., Bridgeport, Conn.	Check 1041
Chicago Bridge & Iron Co., Chicago, Ill.	Check 1042
Lukens Steel Company, Coatesville, Pa.	Check 1043

Heat Exchangers, Vessels

Andale Co., Philadelphia, Pa.	Check 1044
Chicago Bridge & Iron Co., Chicago, Ill.	Check 1045
Doyle and Roth Mfg. Co., Brooklyn, N. Y.	Check 1046
F. W. Glitsch & Sons, Inc., Dallas, Texas	Check 1047
Nooter Corporation, St. Louis, Mo.	Check 1048
Pfaudler Div., Pfaudler Permutit Inc., Rochester, N. Y.	Check 1049
Struthers Wells Corp., Warren, Pa.	Check 1050

Plate Heat Exchangers

Dean Products, Inc., Brooklyn, N. Y.	Check 1051
Tranter Manufacturing, Inc., Lansing, Mich.	Check 1052

Wire Cloth

Cambridge Wire Cloth Co., Cambridge, Md.	Check 1053
Cleveland Wire Cloth Mfg. Co., Cleveland, Ohio	Check 1054
Newark Wire Cloth Co., Newark, N. J.	Check 1055

Tube, Coils and Pipe

Gray Tool Co., Houston, Texas	Check 1056
Joseph Oat & Sons, Inc., Philadelphia, Pa.	Check 1057
Saffran Engineering Co., St. Claire Shores, Mich.	Check 1058
Superior Tube Co., Norristown, Pa.	Check 1059
Titanium Metals Corporation of America, New York, N. Y.	Check 1060
Wolverine Tube, Div. of Calumet & Hecla, Allen Park, Mich.	Check 1061
Youngstown Welding & Engineering Co., Youngstown, Ohio	Check 1062

Pumps

The Aldrich Pump Co., Allentown, Pa.	Check 1063
Buffalo Pumps, Div. Buffalo Forge Co., Buffalo, N. Y.	Check 1064
Chempump Div., Fostoria Corporation, Huntingdon Valley, Pa.	Check 1065
The Duriron Co., Dayton, Ohio	Check 1066
Eco Engineering Co., Newark, N. J.	Check 1067

Valve and Fittings

Fabrivalve Corporation of America, Portland, Ore.	Check 1068
Hoke Valve Co., Gresskill, N. J.	Check 1069
Taylor Forge & Pipe Works, Chicago, Ill.	Check 1070
Tube Turns, Div. of Chemetron Corp., Louisville, Ky.	Check 1071
The Wm. Powell Co., Cincinnati, Ohio	Check 1072

Miscellaneous

Astrofab, Inc., Wooster, Ohio — heat exchangers, vessels, pumps, valves, tube, pipe	Check 1073
B. H. Hubberts & Son Inc., Baltimore, Md. — steam-jacketed titanium kettles for food processing equipment	Check 1074
Improved Machinery Inc., Nashua, N. H. — titanium-lined chlorine dioxide mixers for pulp and paper	Check 1075
Kay Industries, Inc., Detroit, Mich. — miscellaneous welded fabrication	Check 1076
Mixing Equipment Co., Inc., Rochester, N. Y. — mixers	Check 1077
Offenhauser Co., Houston, Texas — ducts, pressure vessels	Check 1078
Standard Steel Corp., Los Angeles, Calif. — drum dryers	Check 1079
Vulcan Manufacturing, Cincinnati, Ohio	Check 1080

Check 1081 opposite last page.

CHEMICAL BUSINESS

CP Staff Photo

Competition *for U.S. manufacturers can spring up in unexpected forms in Europe. Here, at far left, a trough-screw "pump" draws the attention of ACHEMA visitors*

U.S. ACHEMA exhibitors optimistic about European CPI markets

But, say many, you'd better provide effective service and spare-parts backing, and be aware of standards and codes in the various countries. Don't overlook the advantages of manufacturing overseas, either . . .

Some 40 U.S.-identified companies exhibited at the June ACHEMA Chemical Engineering Exhibition-Congress in Frankfurt (Main), Germany. CP editors interviewed company spokesmen in their booths to get their views on doing business in Europe. This article is a cross-section of opinions of these men, most of whom have had years of valuable experience in selling U.S. products to Continental customers.

(See September CHEMICAL PROCESSING, page 29, for a report on major foreign developments displayed at the 1400-exhibit, 20-acre show.)

SCENE: The sprawling ACHEMA 1961 exhibition in Frankfurt, Germany.

American Exhibitor A: "We've been manufacturing over here for three years and our sales so far are just about doubling every year."

American Exhibitor B: "See this little thumbscrew holding on the cover? Wrong thread pitch for Europe. You have to send to the States for a replacement. It's really tough to sell American equipment here."

Between the optimist and the pessimist, every American company selling equipment to the chemical processing industries in Europe can find its own line in the spectrum. Some have been manufacturing in Europe for so long they are almost as much a part of the Continental scene as the Krupp empire celebrating its 150th anniversary. Some new firms are riding the crest of the unprecedented capital-investment boom throughout Europe which the chemical industry is leading. A few, even newer, used ACHEMA to look for representatives and distributors.

No matter how the 40 or so American exhibitors at ACHEMA found the selling — and few would admit to doing less than well — they were unanimous in believing a significant future is before them on the Continent. No one gave any signs of pulling out.

"When you try to sell American equipment in Europe, the first reaction you get is 'high prices'," comments an official for Manton Gaulin in its booth exhibiting high-pressure dispersing equipment, homogenizers and pumps. With a Geneva, Switzerland, subsidiary and manufacturing facilities in Britain, Manton Gaulin solves the price problem simply: "We quote them American prices and quick delivery; or British prices and a long delay."

Lengthening delivery times on machine tools and industrial equipment of all types from the British and German machinery industries is a boon to many American firms. There are also signs that the Japanese are trying to capture some of the European market, though their own boom is putting pressure on domestic capacity.

Rapid European expansion of production and capacity in chemical products long heavily exploited in the U.S. also can open up opportunities for equipment makers. Dorr-Oliver, for instance, is finding such good European demand for a pressure centrifuge developed in the U.S. to remove catalysts from high-density polyethylene that it has just about decided to manufacture the machine on the Continent. The company, sub-contracting out the actual machinery manufacture, is operating in Wiesbaden (Germany), Amsterdam, Brussels, Milan and Croydon (England).

All the proverbial know-how of American selling and manufacturing skill is lost in Europe, though, if it isn't backed up with an adequate service organization. The suc-

cess Tracerlab has had selling its radioactive-isotope devices is attributed, by German customers, to the reputation for a first-rate Continental service group. Other firms, too, have found that sales organizations without good service backing and spare-part stores just don't sell very much.

A spokesman for Sparkler International, Ltd., producing filters for the chemical and drug industries at Amsterdam since 1951, and more recently in Italy, notes that equipment codes on the same pieces of gear differ slightly between countries. Some types of equipment, therefore, have to be manufactured or altered to fit the code of the customer's country. While equipment can be made and sold to ASME codes, he notes, the seller may have to fly an inspector over from the U.S. to certify the installation.

Problems of selling American equipment begin with such basic matters as the difference between the metric measurement system and ours, which can sometimes be cured by a simple recalibration of a dial. Apparently minor differences in pitch of screw threads, however, don't remain trivial when equipment is in some relatively isolated south German factory. Then, too, there are the problems of national psychology, some remaining "resentment" of America, and the inexpertness of many small American firms in handling the complicated export currency problems for some deals.

The ACHEMA 1961 exhibitors from America were practically unanimous that the most satisfactory way to solve these problems and attack the European market is to manufacture on the Continent, or at least assemble equipment there. Nuclear-Chicago and some other atomic instrument producers were the only firms who found lack of Continental manufacturing no bar to full market exploitation. And even the nuclear instrument firms are moving abroad: Tracerlab into a factory at Antwerp and Baird-Atomics into Kleve, Holland.

A German sales engineer for

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ACHEMA exhibitors

From preceding page

Honeywell of Frankfurt, subsidiary of Minneapolis-Honeywell, notes that since it started manufacturing three years ago, selling has been much easier in most parts of Germany. He adds that it's still hard to sell American equipment in south Germany where "people are more conservative."

U.S. Instruments Find Growing Market

Consolidated Electrodynamics Corp., now a division of Bell & Howell, reports that there is a developing market for electronic control devices in Europe now, but Continental firms are rapidly closing the gap on America's lead. Consolidated has had German sales offices for three and a half years. It has decided to go into manufacturing overseas, and is looking for a site.

The Honeywell sales engineer believes American instruments are about five years ahead of their European counterparts. He notes particular good reaction from German chemical firms for automatic printing and recording instruments capable of reporting 12 or more points simultaneously.

American leadership in instrumentation is a hotly debated topic among U.S. representatives in Europe. A Consolidated Electrodynamics man disputes the absolute leadership theory with the contention that America's real ace is the broad application of instruments and control devices. "Europeans know as much about instruments themselves as we do," he argues.

The shortage of labor in Germany and increasing pressure on chemical profit margins all over the world is increasing the willingness of Europe's companies to install automatic equipment on a large scale. In addition there is a growing tendency to think of devices and instruments as investments which can be quickly amortized. This favors a more rapid swing to the most modern equipment from America.

The common story among American firms is for the European manufacturing operation to cooperate with de-

velopment laboratories in the U.S. for modification of existing equipment to meet Continental demands. For most firms, the basic development of new equipment is still being done by the American parent firm.

But some firms are now beginning to report useful feedback to the States of new developments by their European children. Perkin-Elmer's German unit has developed a new infra-red spectrophotometer which may have wide use in process control. Company officials from Bodensee proudly claim that Perkin-Elmer in Connecticut will make the instrument to their designs, for sale in the U.S.

Even where direct manufacturing isn't undertaken, assembly operations may be useful in Europe. Morehouse International is now assembling its line of dispersion and dissolving equipment in Brussels. The parts for this equipment are imported from America. The Brussels plant also maintains a large stock of spare parts.

'Old Timers' Return After World War II

While most of the U.S. ACHEMA exhibitors now manufacturing in Europe started up after the war, and many since 1955, there are some who returned to pre-war plants after World War II. Worthington Corp. picked up the remnants of its German business in 1948. Before the war it produced steam pumps in Berlin; now, in Hamburg, it makes pumps and other products, including certain products of Mason-Neilan one of Worthington's divisions. But Worthington's European operations also include two factories in France, two in Italy, and one each in Austria, Spain and Britain.

Pfaudler is another old-timer on the Continent. It has rebuilt its German plants and now makes virtually the same line of equipment as the American parent, which still handles most of the research and development.

Some firms, long established in one European country, are

To next page

ACHEMA exhibitors

From preceding page

now branching out to take advantage of the Common Market's spur to capital building. Wallace & Tiernan has been manufacturing in Britain for 35 years and for six years at Guenzburg in Germany. Except for precision calibrating instruments, the company now imports little from its home plants for European sale.

Wallace & Tiernan's English manager is emphatic on the need to manufacture on the Continent to achieve maximum sales there. Its ACHEMA exhibit, double the size of its 1958 stand, concentrated on accurate dry chemical feeders for chemical blending or water works.

Sharples Corp., with a factory in Duisberg and sales offices in Dusseldorf, is another exhibitor convinced of the sales usefulness of ACHEMA. This was its third time, and each exhibit has been larger, a spokesman says. By the second day, Sharples men reported sales of several continuous-discharge separators.

One interesting variation of American subsidiary operations in Europe is the license Niagara Filters' Dutch unit has to make candle filters from Lewis de Marcus of Buffalo. Niagara has been manufacturing in Holland for 10 years.

Will these firms be back in 1964? Most of them are actively making plans to return to the next ACHEMA. The exposition's leaders reportedly are planning to have even greater international representation at the 1964 event. Many firms at Frankfurt in June were already putting in bids for preferred space at the next exhibition. ■

NEXT MONTH

Many CPI operations are of the batch type, and will probably never be converted to continuous processes. Often overlooked is the fact that such batch operations often can be made considerably more efficient through the use of end-point programming. An up-to-the-minute report on this technique appears in these pages next month.

Nitroparaffin derivative upgrades alkyd resins

Chemical resistance and improvements in drying time, adhesion and gloss retention result when coatings are formulated with alkyds modified with Tris (hydroxymethyl) aminomethane

WITH its formation by Commercial Solvents Corporation recently, the Nitroparaffins Department took its place beside three long-established selling divisions.

Although nitroparaffins are well established now, they have gone through a 20-year commercial development program.

Credit for developing a laboratory process that might be expanded to a plant scale goes to Dr. E. B. Hodge, who, as a graduate student working under Dr. H. B. Hass at Purdue University, discovered a method of vapor-phase nitration of propane which gave four products: nitromethane, nitroethane, 1-nitropropane and 2-nitropropane, each with valuable chemical and physical properties. Today, these four products, along with more than 30 of their derivatives, are being successfully marketed.

Commercial production was achieved when the plant was brought on stream in 1955. Industry applications vary from can coatings to drilling muds and from hair dyes to shoe polishes.

Largest volume markets have appeared as solvents for industrial coatings such as vinyls, epoxies, acrylics and polyurethanes. Solvent properties of 2-nitropropane have provided such improvements as higher solids content, less cob-webbing in spraying, faster drying time, better adhesion, improved flow, elimination of pin-holing and substantial cost savings.

Early in the developmental program it was found that the material should not be offered as a direct replacement for some other solvent but should be evaluated as a possible source of desirable properties not present in the user's current product.

Derivatives Useful in Coatings

One of the more important applications for nitroparaffin derivatives is in the coating field. Recent work has shown that considerable upgrading of alkyd resins can be achieved by incorporating in the formulation relatively small amounts of tris(hydroxymethyl) aminomethane or "Tris Amino." When conventional alkyds are modified by replacement of 10 mole percent of the polyol with Tris Amino there is improved acid resistance, salt-spray resistance, gloss retention, adhesion and drying time.

Structurally, Tris Amino resembles pentaerythritol, the difference being that one of the methyl hydroxy groups is replaced with an amine, as shown in Fig 1.

Many Reactions Possible

Depending upon conditions, the material can undergo a number of reactions in alkyd manufacture, but the predominent one is the formation of a substituted oxazoline.

Reactions of Tris Amino in resin cooks are at best only partially understood. The amino group which makes the material a unique polyol for oils and resins complicates greatly the reactions that can occur. This is illustrated in Fig 2, where the simple reaction between one mole of Tris Amino with one mole of fatty acid is carried out.

Upon heating, the soap formed as a result of the reaction in Fig 2 will dehydrate to the amide, as shown in Fig 3. The amide can be further dehydrated via ring closure to a substitute oxazoline as shown in Fig 4.

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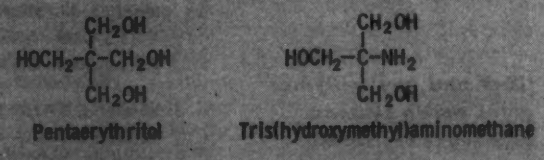
Tris Amino structure resembles pentaerythritol

FIG. 1



Three-step reaction shows formation of a substituted oxazoline

FIG. 2

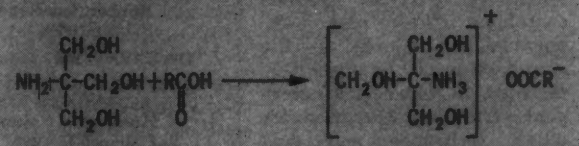


FIG. 3

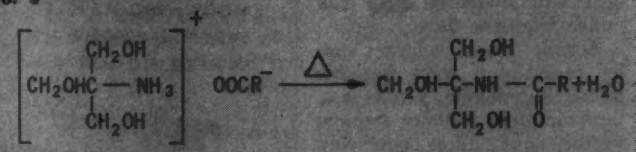
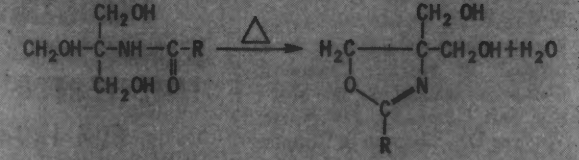


FIG. 4



A modified polypropylene with toughness, rigidity over wide temp range

Uses: Product is designed for molding operations. Potential applications are foreseen in manufacture of electronic components, wiring devices.

Features: Manufacturer reports that thermoplastic has high rigidity and heat distortion values along with excellent dimensional stability and creep resistance. Chemical resistance and low moisture absorption are reported to be superior to competitive materials.

Description: Modified polypropylene is now available as a blue-gray molding resin in experimental quantities at a price of $0.36 per pound on a volume basis. It can be processed substantially the same as unmodified polypropylene. A flame-retardant grade is expected to be available soon.

(Oleform modified polypropylene is a product of Avisun Corporation, 1345 Chestnut St., Philadelphia 7, Pa.)

Check 1087 opposite last page.

'Lock and key' polymer gives polish systems detergent resistance

Polish polymer is designed for alkali resistance and acid sensitivity. Polish systems containing "lock and key" polymer are reported by the manufacturer to be absolutely resistant to water and detergent scrubbing. Designed for alkali resistance and acid sensitivity, a specific dilute acid will instantly strip the polish from the floor.

Acrylic based polymer can be formulated with familiar polish ingredients. Floors can be maintained without damage to the polish film, sacrificing gloss or any properties commonly associated with dry-bright polishes.

(Lock and key polymer is a product of Morton Chemical Company, subsidiary of Morton Salt Company, 110 North Wacker Dr., Chicago 6, Illinois.

Check 1088 opposite last page.

Nitroparaffin derivative *From page 43*

If the principal product is an amide, a functionality of four could be assigned, but for oxazoline formation the functionality is three. Since there are several competing reactions, the actual functionality attained in alkyd resin manufacture has been found to be somewhat greater than three or about three and one-quarter. Thus, when formulating glyceryl alkyd, the excess hydroxyl should be kept somewhat lower than normal because of Tris Amino's slightly higher functionality. It is also to be noted that an additional mole of water is released by the closing of the oxazoline ring.

Imide Formation Affects Color

When Tris Amino is used in an alkyd formulation with phthalic anhydride or other di-acid anhydrides, there is a tendency for the Tris Amino to form the imide, which is undesirable since a considerable amount of bi-functional acid is removed from the reaction. The latter circumstance makes the acid unavailable for cross-linking, a condition possibly contributing to increased color in the finished alkyd. For example, attempts to prepare an alkyd from Tris Amino as a total polyol and phthalic anhydride as a dibasic acid have caused as much as 50% of the Tris Amino to be converted into an imide.

Imide formation in alkyds modified with Tris Amino can be largely avoided by the procedure outlined in Table 1. Improvements in the alkyd can be obtained by replacing approximately 10 mole percent of the polyol with Tris Amino but not until after the phthalic anhydride has been partially reacted. Procedural data outlined will give alkyds with satisfactory final acid numbers.

Avoiding Insoluble Polyester Formation

A problem encountered in cooking alkyds has been the formation of a small amount of insoluble polyester during the cook. It is hard, insoluble and easily filtered out of the batch. At a level of 10% Tris Amino, this material does not ordinarily exceed 0.5-1.5% of the total weight of the charge. If the amount of Tris Amino is increased, the quantity of insoluble polyester obtained also increases. At 20% Tris Amino, as much as 10% of the total weight of the charge may be converted to insoluble polyester. Even after removal of this much of the charge, and despite the relatively low body of the remaining alkyd, properties of these resins are superior to those containing only 10% Tris Amino.

Formation of the insoluble resin can be eliminated by increasing the excess hydroxyl content of the resin; however, when this is done, the improvement in properties noted from the use of Tris Amino is lost. No appreciable amount of the insoluble polyester is formed when Tris Amino contents are below six mole percent; however, at this level very little, if any, improvement is shown in the properties of the alkyd.

Generally, alkyds cooked from equivalent raw materials and containing Tris Amino at levels of 10% replacement of the polyol have been found to be only very slightly darker in color than alkyds containing no Tris. This difference is usually one or less on the Gardner scale.

Drying times of the alkyds are roughly equivalent, as are bodies and rates of reduction of the alkyds.

Most of the work done in the testing of Tris Amino has been with medium-oil alkyds made from linseed or soya-oil fatty acids, glycerine and phthalic anhydride.

Formulations and procedures shown in Table 1 compare the results obtained with a Tris Amino modified alkyd versus a typical alkyd.

(Tris Amino is a product of Commercial Solvents Corporation, 260 Madison Avenue, New York 16, New York.)

Check 1090 opposite last page.

TABLE 1

Comparison of Tris Amino modified alkyd with typical alkyd

Materials:

1.61 moles 450 g — Soya Fatty Acid (Emery 618 or equivalent)
2.38 moles 219 g — Glycerine (99%)
2.58 moles 382 g — Phthalic Anhydride
0.260 moles 32 g — Tris Amino

1083.0 g
— 80.1 g H_2O
1002.9 g

Procedure:

1) Fatty acid, glycerine, phthalic anhydride charged to a resin pot.
2) Heat to 235°C and maintain an inert gas blanket (satisfactory alkyds have been made using solvent or fusion methods).
3) Hold for acid value of approximately 50.
4) Cool to 190°C.
5) Add Tris Amino; reheat to 210°C
6) Hold for acid value of approximately eight.
7) Cut to 50% solids with mineral spirits.

Properties:

Viscosity Z_3 (50% in mineral spirits)
Color 6 (50% in mineral spirits)
Solids 50% in mineral spirits

Typical Alkyd Used For Comparison

Materials:

1.61 moles 450 g — Soya Fatty Acid (Emery 618 or equivalent)
2.66 moles 245 g — Glycerine (99%)
2.58 moles 382 g — Phthalic Anhydride

1077.0 g
— 75.5 g H_2O
1001.5 g

Procedure:

1) Fatty acid, glycerine, phthalic anhydride charged to a resin pot.
2) Heat to 235°C and maintain an inert gas blanket.
3) Hold for acid value of approximately eight.
4) Cut to 50% solids with mineral spirits.

Properties:

Viscosity Z_4 (50% in mineral spirits)
Color 5 (50% in mineral spirits)
Solids 50% in mineral spirits

High solvating power feature of plasticizer for vinyl flooring

Uses: Product is tailored to the requirements of vinyl flooring. In addition its reported to be an effective plasticizer for vinyl film, extruded goods, foam, copolymer resins and acrylic lacquers.

Features: Plasticizer features high solvating power combined with fast solvating action. Manufacturer states there is less migration to asphalt and rubber and lower asphalt solvation.

Description: Product, Flexol plasticizer RK-1 minimizes problems encountered in use of asphalt- or rubber-base adhesives for vinyl-asbestos flooring. Prices range from 24½ cents per pound to 27¼ cents per pound depending upon location and quantity.

(Flexol plasticizer RK-1 is a product of Union Carbide Chemicals Company, division of Union Carbide Corporation, 270 Park Avenue, New York 17, New York.)

Check 1092 opposite last page.

Role in resins, fabrics, and paper predicted for acrolein derivative

Uses: Product can be used in crosslinking hydroxyl containing materials, as an effective starch modifier, as well as a co-reactant with resin constituents such as phenol.

Features: Fabric finishes based on the product are completely resistant to chlorine damage. Starch-based adhesives can be rendered water insoluble. Product can be used as an anchor coat for cellophane, a modifier for polyvinyl alcohol, carboxymethylcellulose and other polymers.

Description: Aldocryl X-12 is a low molecular weight acrolein condensate similar to aldehydes in chemical reactivity. It is available as a storage stable, pale yellow, 50% by weight aqueous solution with a mild irritating odor. Flash point (TOC) is 190°F.

Acute oral tests on animals

show that X-12 is only a moderately toxic chemical. However, it is highly irritating to the eyes and may produce dermatitis on prolonged or repeated skin contact.

(Aldocryl X-12 is a product of Shell Chemical Company, Div. of Shell Oil Company, 110 West 51st St., New York 20, N.Y.)

Check 1094 opposite last page.

Powdered wax resists solvents, acids

Uses: Versatile wax can be used as a plastic lubricant, anti-blocking agent and anti-tack agent in adhesives. Should find application as an extender or substitute for Carnauba wax and will impart slip and mar resistances to the lacquers.

Features: Wax resists practically all solvents, acids and alkalis.

Description: Called Advawax 280-F, the finely ground, powdered wax (100% through a hundred mesh screen) is hard, light colored and high melting, 280 to 290°F.

(Advawax 280-F is product of Advance Solvents & Chemical, 500 Jersey Avenue, New Brunswick, New Jersey.)

Check 1095 opposite last page.

"I said, can we handle an order for 50 million lb of boron trifluoride?"

By GEORGE M. NEAS,
Principal Engineer
Chemical Processing
American Viscose Corporation
Marcus Hook, Pennsylvania

Cation exchanger licks resin degradation problem

Chemical and physical stability built into polymeric structure of new-type cation exchanger solves water-treatment problem at American Viscose

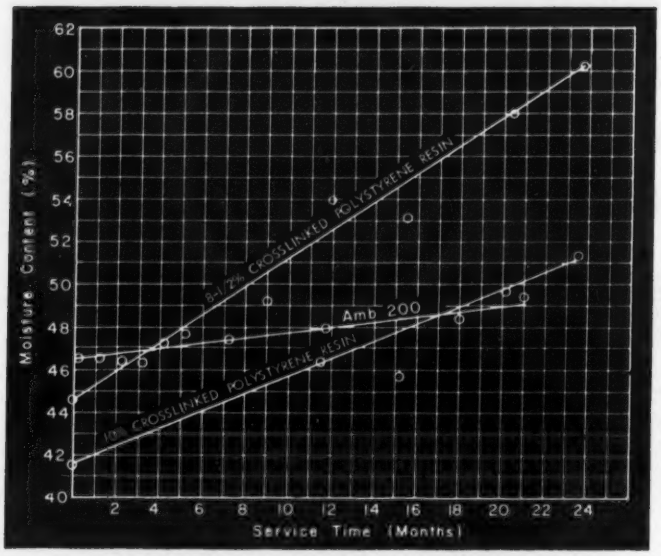


Fig. 1) Amberlite 200 has less than 3% change in moisture content after 21 months' service

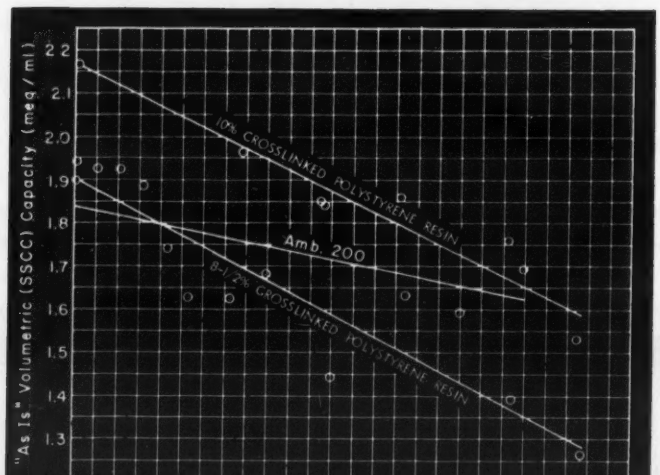


Fig. 2) Volumetric capacity drops off less for Amberlite 200 than for other resins

IN 1957 The American Viscose Corporation experienced serious problems in the ion-exchange water-softening units at several of its plants.

A NEW SOLUTIONS FEATURE

The pressure drop through the resin beds had increased to the point where it was no longer possible to maintain the required flow of softened water. Soft water is essential to the operation of the plants, and it was evident that at some locations immediate replacement of the resin was required.

Moreover, since the resin installation at all plants represented a major capital investment, trouble in the softener units could be serious. Hence, an investigation was started to determine the source of the trouble and to find a feasible solution.

It was soon apparent that the resin failure was caused by the presence of chlorine and trace quantities of metals — such as copper, manganese and iron — which attacked the resin. This resulted in a swelling and softening of the beads used, restricting the flow of water through the beds. In certain plants where immediate replacement of the resin was required, the conventional 8½% crosslinked resin, representing the product of two different manufacturers, was first replaced with 10% crosslinked resin. After a time, when the newly developed Amberlite 200 resin became available, test baskets of this resin were installed in the top of the resin tanks at three of the plants. When tests, based on detailed records of the performance of the new resin, proved promising, a full-scale plant test was ordered. The Fredericksburg plant of American Viscose Company was chosen for the test inasmuch as the greatest resin difficulty had been experienced there.

Four softening tanks were used in the study which was started in 1959. Two contained 8½% crosslinked resins; one, a 10% crosslinked resin; and one was charged with the new-type product, Amberlite 200.

Over the past two years the resins in the units have been sampled monthly and detailed studies of moisture content and exchange capacity of the resin made every three to six months.

Each unit at this operation contains 125 cu ft of resin and the flow rate is seven gpm per cu ft. Prior to softening, the raw water is clarified, coagulated, filtered and chlorinated (0.3 ppm residual chlorine). Depth of the bed is 24", which is the minimum depth recommended for an industrial softening operation.

Results of the two-year operation on the three resins are shown in Figs 1 and 2. The three types of resin (8½% crosslinked, 10% crosslinked and Amberlite 200) represent 23.7, 23.5 and 21.0 months of service after treating 193, 220 and 192 million gallons of

Table 1 — Effect Of Osmotic Shock On Resin Fracture after 2000 cycles (all resins 100% +30 mesh initially)

Screen Fraction %	Amberlite 200	Standard and Premium-grade Resins
+30 mesh	99+	53 to 87
−30, +50 mesh	0.1	12 to 40
−50 mesh	0	1 to 7

water, respectively.

Fig 1 correlates the average moisture content (for three sampling depths) against service time. This shows that the moisture content of the 8½% crosslinked resins has increased 50%, the 10% crosslinked resin 30%, and the Amberlite 200 less than 3%.

Fig 2 is a correlation of the average volumetric salt-splitting capacity against service time. During the period of the test, capacity of the Amberlite 200 appeared to decrease approximately 10%, while that of the other resins decreased from 30% to 50%. However, the tests indicated that while much of the capacity decrease with the conventional resins was irreversible (indicating resin degradation), the capacity loss of the Amberlite 200 was apparently due only to iron fouling. Cleaning with hydrochloric acid restored the capacity of the resin to almost its original value. ■

Fundamental Data on Amberlite 200

Additional operating data on the new resin referred to in the American Viscose case history is given in these columns. Rohm & Haas, manufacturer of the resin, points out that the widespread need for a stable, shock-resistant resin in industry prompted the research which has resulted in the development of the new cation exchanger.

Amberlite 200 is described as a sulfonic-acid-derivative of a modified styrene-divinylbenzene copolymer. According to the manufacturer it represents a new concept in polymer chemistry which produces a resin with unusual chemical and physical stability built into the polymeric structure of the resin. As borne out in numerous commercial operations, including the example

To next page

Table 2 — Comparison of Oxidative Resistance

Moisture %	Amberlite 200	Standard Resins	High Crosslinked Premium Resins
New Resin	47	45	46
3% H_2O_2 for 72 hr	55	83	76

Table 3 — Sodium Cycle Data

Regeneration Level (lb NaCl/cu ft resin)	4	6	8	10
Capacity (kgr* as $CaCO_3$/ cu ft resin)	15.2	18.6	20.7	22.2
Regeneration Efficiency (lb NaCl/Kgr* removed)	0.26	0.32	0.39	0.45

*Kgr = kilograins

cited, the resin is especially suited for use in areas where decrosslinking and attrition are encountered — where conventional resins and even the 10% crosslinked types fail to give the desired service.

Physical Characteristics

Amberlite 200 is supplied in moist, sodium form and is characterized by extremely hard, tan spherical particles.

Moisture content	47-52%
Screen grading (wet)	16-50 mesh
Effective size	0.45-0.60 mm
Uniformity coefficient	2.0 max
Fines content	2% max through 50 mesh

Resin's Strength Measured By Shrinking, Drying

All ion exchange resins shrink as water is desorbed during the drying process and expand when rewet. Although these resins are rarely completely dried and rewet, the severity of this action affords a method of estimating the ability of the resin to withstand the numerous volume changes that occur in a normal operation of exhaustion and regeneration. A laboratory study comparing breakage of Amberlite 200 with standard and premium-grade resins over a number of wet-dry cycles showed that particle-size reduction of standard resins was six to 15 times greater, and premium-grade resin breakage was two to four times more severe than Amberlite 200.

Effect of Osmotic Shock

The subjection of a cation-exchange resin alternately to saturated brine and dilute calcium chloride solutions simulates closely the osmotic shock that a resin encounters during a water-softening and regenerating operation. Table 1 summarizes the data obtained from a study on the new resin as compared with typical standard and the so-called premium-grade white resins.

During cycling, an appreci-

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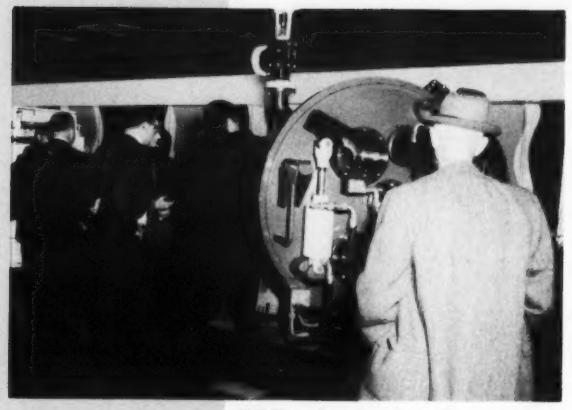

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able volume change occurs as each resin is partially dehydrated by contact with the saturated salt solution and rehydrated by contact with rinse water and the dilute calcium chloride solution. The study was conducted with -20 +30 mesh screen cuts of each resin and the samples were re-screened after 2000 cycles. The negligible change in the particle size of the new resin, as shown in Table 1, means little change in pressure drop will occur in service, and there will be substantially less resin loss during backwash over extended periods of use.

Moisture Retention Ability Key to Life of Resin

The stability and operational characteristics of exchange resins are directly related to the moisture content of the resin. Thus, a resin which retains its initial moisture content over a longer period will be the resin that has the longer useful life. Aggressive solutions containing oxidants such as dissolved oxygen and chlorine, along with traces of metallic ions like iron, manganese and copper, cause rapid increase in moisture content of standard cation exchange resins.

A laboratory test illustrates the oxidative resistance of the new resin as compared with that of the standard and premium-grade resins. All three resins were placed in a solution of 3% hydrogen peroxide at 45°C for 72 hours. At the end of this period, the moisture content of each resin was determined. Table 2 summarizes the comparison of the standard and premium resins with the new resin.

Amberlite 200 is used in the sodium cycle to remove the multivalent metallic cations which contribute to hardness in many water supplies and cause scale formation in heat exchangers and hot-water boilers.

The relationship between

For more information on product at left, specify 1099 . . . see information request blank opposite last page.

CHEMICAL MATERIALS

capacity and regeneration level in the sodium-cycle operation is summarized in Table 3. These values were determined by the use of a one-inch-diam column, an exhausting solution containing 500 ppm $CaCl_2$ as $CaCO_3$ (0.01 normal), a 10% NaCl regenerating flow rates of 2 and 1 gpm per cu ft of resin, respectively.

Chemical Characteristics

Exchange Capacity: Minimum total exchange capacity of the new resin on a weight basis is 4.30 meq per gram of dry resin. On a volumetric basis, the minimum total exchange capacity is 1.75 meq/ml of wet, backwashed and drained resin. This is equivalent to 38.2 kilograins as calcium carbonate or 0.11 lb equivalents of cations per cu ft of resin.

Actual operating capacity, as with other resins, will always be less than total capacity. Flow conditions, regeneration level and composition of the influent solution are the major factors preventing complete utilization of total capacity in columnar operations. In addition, the usual practice of terminating the exhausting cycle as soon as cation leakage reaches a low, predetermined value prevents complete exhaustion of a portion of the resin bed.

Temperature Stability: Material may be used in either hydrogen or sodium cycles at temperatures up to at least 250°F.

pH Stability: Resin is stable over the entire pH range. However, a reduction in the exchange capacity can be expected when treating solutions at a very low pH.

Chemical Stability: Material is insoluble in water, aliphatic and aromatic hydrocarbons and all other common solvents. Its outstanding property is that it resists chemical attack when exposed to oxidizing conditions.

(Amberlite 200 is a product of The Rohm & Haas Company, Washington Square, Philadelphia 5, Pennsylvania.)

Check 1101 opposite last page.

Dicyclopentadienyl iron useful as intermediate for organometallics

Development quantities of dicyclopentadienyl iron are now available. Compound is finding growing applications as a combustion control additive; as a high temperature lubricant; in thermally stable polymers; and as an ultraviolet absorber. It has a low order of toxicity and is thermally stable.

Compound, commonly called Ferrocene, has an iron atom sandwiched between two cyclopentadienyl rings lying in parallel planes. It is highly soluble in hydrocarbons but insoluble in water. Price in development quantities is $10 per lb.

(Ferrocene is a product of Ethyl Corporation, 100 Park Ave., New York 17, N.Y.)

Check 1102 opposite last page.

Five barium organic salts are now available develop mentally

Barium phytate, sulfostearate, benzene-sulfonate, hydrogen cyanurate and dihydrogen cyanurate are now available in development quantities. Recommended uses include adhesion and hardness improvers for water thinned paints; flexibility improvers for solvent thinned paints; slip agents for polymers; oil emulsifier and flotation agents; and vinyl stabilizers. They can also be used in formulating cutting and metal working and grinding compounds and as rust preventatives for oils and greases.

(Barium organic salts are products of Mineral Products Division of Food Machinery and Chemical Corporation, 161 East 42nd St., N.Y. 17, N.Y.)

Check 1103 opposite last page.

For more information on developments reported in this section, check corresponding numbers on Reader Service Slip opposite last page of this issue.

Polyolefin resin family bids for more uses with four additions

Commercial availability of four new members in low-molecular-weight polyolefin resin family has been announced. This brings the total to 12.

Epolene C-11 is a high density (0.947) non-emulsifiable resin designed to use in modifying low-molecular-weight polyethylene and polyterpenes. Grease and moisture vapor transmission resistance is provided.

Epolene C-12, a low cloud point flexible resin, gives wax coating blends high gloss and good scuff resistance. It is a modifying resin for carton coating formulations.

Epolene E-13 was developed for use in paraffin blends to achieve low odor level.

Epolene E-14 is an emulsifiable resin with a low softening point for floor polishes and textile emulsions.

(Epolene C-10, C-12, E-13 and E-14 are products of Eastman Chemical Products, Inc., Subs. of Eastman Kodak Co., 260 Madison Ave., N.Y. 16, N.Y.)

Check 1106 opposite last page.

Water repellent resists both dry-cleaning and laundering

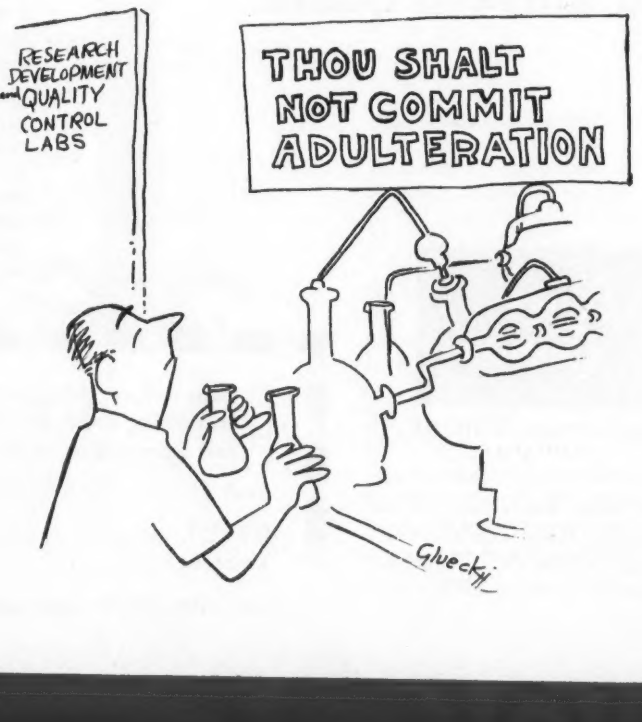
Uses: Water repellent was developed specifically for fibrous materials, such as cotton, wool and synthetics. It is compatible with wash-and-wear resin finishes.

Features: Repellent resists both dry-cleaning and laundering. Manufacturer reports that it equals or betters silicone repellents for resistance to dry-cleaning; it equals or betters pyridine quaternary and stearamide resinous type repellents for wash-fastness. Repellent produces no objectionable odors, thereby eliminating the need to wash fabrics after they are treated.

Description: Water repellent is a white, non-ionic, reactive emulsion polymer of fine particle size with a solid content of 43-45%. It is easily cured on fibrous materials by a wide variety of catalysts, including the preferred catalyst zirconium oxychloride.

(Argus DWR water repellent is a product of Argus Chemical Corporation, 633 Court St., Brooklyn 31, N.Y.)

Check 1107 opposite last page.



Faster molding achieved by using nylon paste in rubber goods

Uses: Multi-purpose rubber extender is miscible with both synthetic and natural rubber.

Features: Actual use testing in a large rubber molding plant showed that molding cycle time can be cut 70 to 80%. Tests indicate that goods have approximately 20 to 25% more tensile strength.

Description: Called Lipco paste, rubber extender is a nylon material which also incorporates an accelerator. After it has been blended with a synthetic or natural rubber compound, the completely integrated molding mass remains stable indefinitely without hardening. This provides a virtually unlimited shelf life.

(Lipco paste is a product of Long Island Plastics Corp., Linderhurst, N.Y.)

Check 1109 opposite last page.

Plasticizer provides low temperature performance

Uses: Plasticizing vinyl resins. Product should be of particular interest to producers of coated fabrics for vinyl foams, vinyl outerwear and other vinyl products that must maintain their physical properties at both high and low temperatures.

Features: Plasticizer has excellent compatibility permitting its use as sole plasticizer for vinyl applications that demand good low-temperature performance.

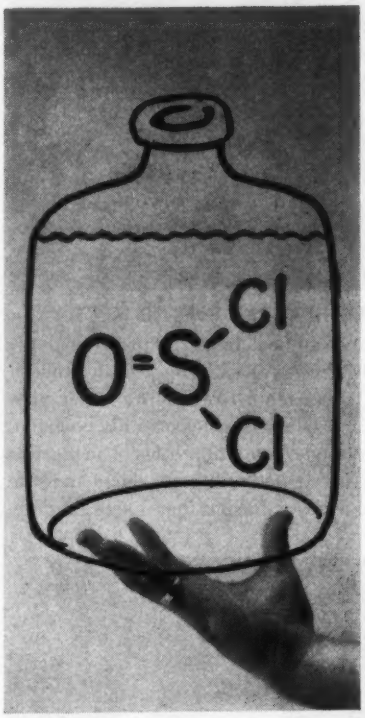
Description: Plasticizer, designated Flexol Z-88, is di-2-ethylhexyl azelate. It exhibits a low degree of extraction by plain or soapy water and is reported to have excellent heat and light stability. It also provides marked improvement in drape, softness and hand of vinyl film, sheeting, and particularly, coated fabrics.

(Plasticizer Z-88 is a product of Union Carbide Chemicals Co., Div. of Union Carbide Corp., 270 Park Ave., N.Y. 17, New York.)

Check 1110 opposite last page.

BRIEFS

Thionyl chloride
Sulfuryl chloride
Phosphorus oxychloride



EASIER WAY TO SULFONATE

In many cases, you'll find it more convenient to work with our thionyl chloride than with pure sulfur.

You can use it to introduce either sulfur or sulfur and oxygen. It also makes an excellent chlorinating agent.

Choose from two grades. The technical grade, 93% pure minimum, distills typically between 72° and 79°C. It is shipped in steel drums.

You get 98.0% minimum purity when you buy the refined grade. It usually contains less than 5 ppm iron, distills typically between 75° and 78°C., and comes to you in glass carboys or nickel drums.

More technical information appears on our data sheet. Just check and mail the coupon.

SWIFTER WAY TO CHLORINATE

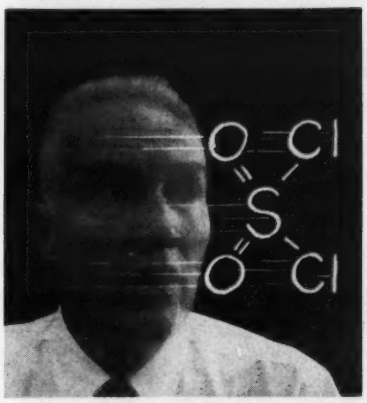
Our sulfuryl chloride, with 2 atoms of chlorine per molecule, provides many a processor with easier, faster chlorination than he can get with elemental chlorine.

In a mixture of aromatic and paraffinic hydrocarbons, for example, you can chlorinate one or the other selectively with sulfuryl chloride just by changing process conditions. Yields are usually high. Reactions seldom require complex equipment.

What else recommends our sulfuryl chloride? It's 99% pure. It gives up much less heat during chlorination than elemental chlorine. It has no flash or fire point.

There's a lot more to the story, which you will find in our technical data sheet.

Send the coupon for your copy.



WHY PHOSPHORUS OXYCHLORIDE WARRANTS A LONG LOOK

You're smart to look into this extremely versatile intermediate if you're developing organic phosphates or plasticizers, gasoline additives, or fire-resistant hydraulic fluids.

You can use it as a catalyst for intermediates and dyestuffs, and in preparation of medicinals such as sulfa drugs.

As a chlorinating agent, it neatly supplements and broadens your already wide choice of Hooker chlorine-containing compounds.

Check the coupon for informative data sheet.

For more information, check here and mail with name, title and company address:

- ☐ Thionyl chloride data sheet
- ☐ Sulfuryl chloride data sheet
- ☐ Phosphorus oxychloride data sheet
- ☐ "Chlorinating Agents," Bulletin 328-B

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Sales Offices: Buffalo Chicago Detroit Los Angeles New York Niagara Falls Philadelphia Tacoma Worcester, Mass.
In Canada: Hooker Chemicals Limited, North Vancouver, B. C.

HOOKER CHEMICALS PLASTICS

Check 1111 opposite last page.

Aleuritic acid, reactive resin intermediate now available in quantity

Uses: Because of position of compound's reactive hydroxyl and carboxyl groups, it can serve as a versatile chemical intermediate in the synthesis of perfumes, pharmaceuticals, plasticizers, resins and adhesives.

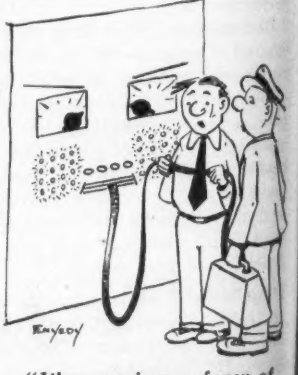
Features: Until recently aleuritic acid 9,10,16-trihydroxypalmitic acid) was available only in experimental quantities. Product is now offered on a commercial scale at a quantity price of $5.75 per lb.

Description: Aleuritic acid is extracted from shellac, a naturally occurring resin. It is soluble in the lower alcohols such as methyl, ethyl and isopropyl. Although insoluble in cold water, it is slightly soluble in hot water.

Properties	
Purity, %	98
Water, %	0.4
Melting Pt, °C	97-99
Acid Value	181-185
Sp gr (20°C)	1.114
Ash	Nil
Odor	Almost odorless
Appearance	Slightly yellow

(Aleuritic acid is available from William Zinsser & Co., Inc., 516 West 59th St., New York 19, N.Y.)

Check 1113 opposite last page.



"It's running a fever of 103.856793283."

G. Enyedy, Diamond Alkali Company

Extended pot life given anhydride resin systems by accelerator

Uses: Product replaces tertiary amines in curing methyl Nadic or other anhydride resins systems.

Features. Material extends pot life of resin formulations and maintains low viscosity. When used in conjunction with manufacturer's epoxy resin system, 211-216, a working life of two weeks at normal viscosity is achieved. Catalyst shortens cure time and is reported to give sharper and truer cures as well as extending high heat operating qualities.

Description: Accelerator, Catalyst 215X will operate in any anhydride system at a level of 2.5 to 5%. It is recommended for use with manufacturer's high temperature epoxy impregnating compounds 211-216.

(Catalyst 215X is a product of Isochem Resins Company, 221 Oak St., Providence 9, R.I.)

Check 1114 opposite last page.

Polyesters for resins made economically by transesterification

Linear polyesters for use in resins, paints and surface coatings can be prepared economically by transesterification. A catalyst that shows promise in direct, trans- and polyesterification reactions is stannous oxalate, now available in commercial quantities.

According to the manufacturer, stannous oxalate appears to be highly versatile and effective in systems such as those using neopentyl glycol-adipic acid, or phthalic anhydride-isooctyl alcohol. A white powder with a density of 3.56 grams/cc, material is slightly soluble in solutions of ammonium chloride and ammonium oxalate. It is insoluble in toluene, ethyl acetate.

(Stannous oxalate is a product of Metal & Thermit Corp., Commercial Development Div., 100 Park Ave., N.Y. 17, N.Y.)

Check 1115 opposite last page.

WHAT'S MISSING?

Packing, mechanical seals and submerged bearings are missing in Galigher Vertical Sump Pumps. THEY ARE NOT REQUIRED. Galigher's exclusive design has eliminated these troublesome parts. Air-lock problems are also missing – Galigher Vertical Sump Pumps positively will not airlock due to their double-suction design! These exclusive features including the thrustless impeller design mean lower maintenance costs and less down time – for either intermittent or continuous operation. Find out for yourself! Place a Galigher Vertical Sump Pump on trial in your plant! Choose from the following wide range of sizes:

Size	1¼"	1½"	2½"	4"	6"	12"
Gallons	50	75	250	600	1500	5000
Heads	18'	35'	80'	100'	100'	80'
Particle size	¼"	¼"	¼"	¼"	½"	¾"
Weight less motor and couplings	80 lbs.	170 lbs.	600 lbs.	1900 lbs.	2100 lbs.	4000 lbs.

Materials of construction for corrosive and/or abrasive service include linings and coverings of Natural Rubber, Neoprene, Hypalon, Buna, Butyl or PVC. Stainless steel, hard iron and other alloy pumps are also available in direct or V-belt driven models.

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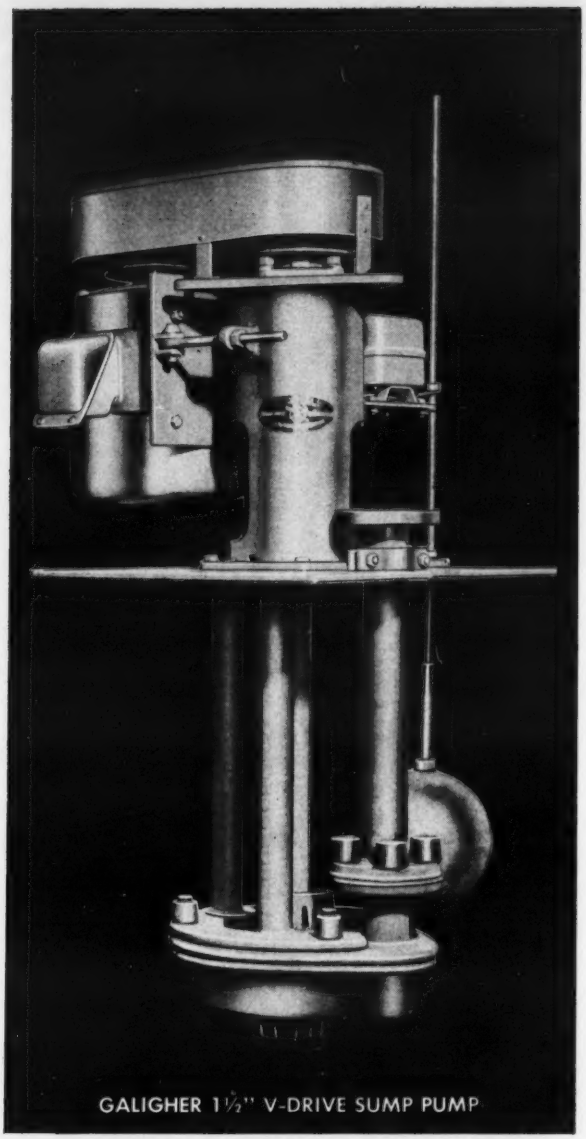
GALIGHER PRODUCTS: AGITAIR Flotation® Machine, VACSEAL Pump, Geary-Jennings Sampler, Acid-proof Sump Pump, Galigher DELTA® Valves, Galigher Squeeze Valves, Rubber Lined and Covered Products, Plastic Fabrication.



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Check 1117 opposite last page.

NEW LITERATURE

Chemical Materials

Methylchloride's storage, transfer and measurement are covered in 14-page bulletin. Topics include emergency handling of leaking containers, handling and supporting cylinders, and transfer by heat or compressor. Methylchloride Product Handling Bul 3 — Ansul Chemical Company.

Check 1118 opposite last page.

Over 90 compounds are detailed in bulletin of 16 pages. Physical data, uses and shipping containers are listed for each product in list that include alkalis, chlorine and sulfur compounds, phosphorus products and plastics. "Hooker Chemicals" — Hooker Chemical Corporation.

Check 1119 opposite last page.

Liquid ion exchangers useful in continuous, countercurrent, anion exchange systems are discussed in four-page brochure. A comparison of ion exchange processes is included. Bul 62 — Rohm & Haas Company.

Check 1120 opposite last page.

Reactions of hexachlorocyclopentadiene are featured in technical bulletin that also covers physical data, toxicity and recommendations for handling. Bul 65—Hooker Chemical Corporation.

Check 1121 opposite last page.

Precious metal catalysts used in hydrogenation reactions are described in data file. Platinum, palladium, rhodium and ruthenium details are presented in outline guides. Examples are given of standard and custom-made catalysts in various forms including powder, pellets, granuals and spheres. "Precious Metal Catalysts" — Technical Service Department, Engelhard Industries, Inc.

Check 1122 opposite last page.

Polypropylene's use in injection molding and extruding is covered in bulletin giving physical and chemical properties and suggested formulas for various methods of processing. Materials Bul No. 9—Eastman Chemical Products, Inc., subs of Eastman Kodak Company.

Check 1123 opposite last page.

Sulfonates for use as catalysts, cutting oils, dyeing assistance and emulsifiers are all treated in technical data sheet of eight pages. Specifications, typical physical properties and suggested application levels are presented for each compound. Data Sheet 559 — Chas. Pfizer & Co., Inc.

Check 1124 opposite last page.

Industrial alcohols are comprehensively treated in 80-page booklet containing data on 21 compounds from methanol to tridecanol. Physical properties; constant-boiling mixtures; specification limits; test methods; storage, handling and shipping; toxicological properties; and selected literature references are included. Special sections describe proprietary solvents, chemical specialties and coatings. "Alcohols" — Union Carbide Chemicals Company, Div. of Union Carbide Corporation.

Check 1125 opposite last page.

Resins for rubber booklet is an illustrated guide outlining how resins make rubber tougher, longer wearing and easier to work with. Booklet 505-3 — Velsicol Chemical Corporation.

Check 1126 opposite last page.

Stripping formulation suggestions for quick acting, safe and easy to use products to remove organic coatings from various metals are presented in product data bulletin. Formulations remove such coatings as phenolics, epoxies, urea and melamine formaldehyde. Bul 8-16 — Armour Industrial Chemical Company.

Check 1127 opposite last page.

Hydrocarbon resins used with natural waxes are covered in bulletin which outlines series of tests made on floor waxes and polishes. Bul 87 — Neville Chemical Co.

Check 1128 opposite last page.

Silicones most useful in production of rubber and plastic materials are subject of eight-page, production-engineering guide. Mold lubricants; polyurethane and plastisol additives; fluid silicone rubber; and silicone release coatings are described. Reference 1-120 — Dow Corning Corporation.

Check 1129 opposite last page.

Lithium chemicals for air conditioning, catalysis, greases, ceramics and other fields are highlighted in technical data bulletin. Selection chart provides a handy reference guide to important compounds and their industrial uses. Bul 108 — Foote Mineral Co.

Check 1130 opposite last page.

Modacrylic fabric used as a protective overlay for glass-reinforced plastic laminates is detailed in eight-page illustrated booklet. Recommended uses, typical methods of application are given for tanks, ducts and industrial structural panels. Form T-2045 — Union Carbide Chemicals Company, Div. of Union Carbide Corporation, Textile Fibers Department.

Check 1131 opposite last page.

"Suitability" tests *From page 29*

sign secrecy agreements. This type of arrangement appears to be popping up more frequently. Where no secrecy clause exists, manufacturers feel that this is implied and the user relies upon the integrity of the supplier and verbal agreement to maintain secrecy.

Mutual secrecy agreements provide protection for both user and manufacturer. In these, the customer agrees not to reveal exclusive equipment designs to competing equipment manufacturers, and the equipment manufacturer holds confidential the data on the product test.

Should the manufacturer be permitted to make use of performance data?

Most users will not permit the use of test data by the manufacturer. In a great number of cases, manufacturers have stated that it is not their policy to *demand* that test data be made available to them. One manufacturer, however, feels that these data should be made available to him when the tests are performed free for the customer.

In only one circumstance did a surveyed supplier *insist* that he should have data developed from such a test. Yet many *prefer* that the information be made available, since it helps to broaden application knowledge.

A number of equipment vendors have found that improvements in equipment designs result from these test operations. They feel that these improvements should be made available to the manufacturer because of his willingness to cooperate in the tests. This is especially true where design patents may result.

There are many gray areas in this customer-manufacturer relationship in testing of equipment. In general, integrity of both parties is a primary factor, and the ethics of American business practices enter the picture.

The big problem here is that of resolving the user-supplier relationship to:

1) Assure the user that his confidential test data will be kept inviolate and that the manufacturer will not use it to help peddle his equipment to the user's competitor.

2) Assure the supplier that his engineering and test data will not be used by the user in purchasing competitive equipment for the job. ■

"Don't tell me you forgot the key!"

Water pollution law

From page 31

Middle Atlantic, Southeast, Midwest, Pacific Northwest and Alaska.

These laboratories will conduct a full range of study and research relating to the prevention and control of water pollution. To the extent practical, the laboratories will be located near institutions of higher learning in which graduate training in water-pollution control may be carried out.

Comment: As the laboratory locations are announced, it is recommended that industry representatives, either individually or perhaps as a committee of the local-regional industrial complex, make early contact with the laboratory staff. Explain to the research staff the local water-pollution situation, as you know it. Point out the efforts made by your companies; point out, too, the problem areas. Offer your cooperation; it will be welcomed. Give consideration to designating a plant executive as your contact with the field laboratory.

These labs will inevitably become the focal point of water-pollution control in their respective areas. Such enforcement as may be needed will stem from the results of their research.

3 Grants to Municipalities

The amended law provides grants to municipalities up to $600,000, or 30% of the estimated cost, whichever is the smaller. Where more than one municipality is served, the grants will be allocated. Municipalities and states now have up to 18 months to obligate funds before they may be realloted to other states.

Comment: This provision of the law has no particular bearing on industry as such except that industry representatives may be in a position to urge communities, of which they are a part, to make prompt and efficient use of the Federal funds available to them.

4 Enforcement Measures Against Pollution of Navigable Waters

Perhaps the most significant of all the amendments, this one

To next page

Water pollution law

From preceding page

deserves careful study by industry representatives. It should be properly evaluated and positively acted upon, because if industry at the local and headquarters level does nothing, the intensified Federal push on water-pollution control can pass industry by and then a company may find itself faced with a rather complex rebuttal situation. Do not find yourself or your company saying, "Why didn't somebody tell us!"

Secretary of HEW Powerful

The new enforcement amendment starts off as follows: "Sec. 8. (a) The pollution of navigable waters in or adjacent to any State or States (whether the matter causing or contributing to such pollution is discharged directly into such waters or reaches such waters after discharge into a tributary of such waters), which endangers the health or welfare of any persons, shall be subject to abatement as provided in this Act." It goes on to say that whenever requested by the governor of a State or a State water-pollution-control agency or, with the concurrence of the above two, the governing body of any municipality, the secretary of HEW shall call an intrastate conference. The Secretary can call a conference on his own initiative in the case of interstate pollution.

Attorney General's Aid May Be Secured

If after public hearings, pollution is not abated in the time specified by the Secretary of HEW he may request the Attorney General to bring a suit on behalf of the U.S. to secure abatement in the case of interstate pollution. In the case of intrastate pollution, the Secretary may request suit only with the written consent of the governor of the State.

Comment: The Federal government is firmly based to exercise a tremendous amount of control. Money is available. Field laboratories will be located in such a way as to pro-

vide Washington with immediate, factual recommendations. Procedures have been set up to provide close, quick liaison between Federal, State and municipal water-pollution-control agencies.

Teeth have been provided for Federal legal action.

Important for Industry To Maintain Rapport

The day of opening the flood gates in the middle of the night has passed. The company which is not aware of this is in for very hard sledding, indeed. At the plant level, it is more important than ever to have strong continuing liaison between the plant and the community and State water-pollution-control agencies. Companies should continue to provide pertinent government bodies such water-pollution-control information as they have.

The CPI spends some $100 million a year in water pollution control and research. The results should be made known. Industry experience should be shared with the government groups who may or may not know the practicalities of local situations.

Be doubly aware if you are an upstream offender and a state line is downstream from you. That neighboring state, with no interest in you, can have you on the legal carpet.

Do not forget the national level, consistent with company policy. Stay in touch with your Senators and Congressmen; in the event of complaints at the Federal level they can be helpful to you. They are the ones who voted the amendments into law and the ones who can make further amendments, if any are needed.

The next seven years will tell the story — from the Houston ship canal to the Great Lakes. Congress has voted $570 million to handle the problem. Make sure your plant location is in step with the times.

A good first step would be to ask your Congressman for a supply of the amended law and circulate the copies as required reading for all operating management. ■

Leasing plan for data-logging trailer cuts cost of computer evaluation

Mobile unit, which can be easily moved to site of operation, makes a continuous record of dynamics of process, permitting operating management economically to evaluate need for:

- **computer control**
- **process changes**
- **equipment replacement**

Feature of data-logging trailer being built for Shell Chemical Company is pull-out reels for input cables mounted on rear. Normal cable length is several hundred feet. Aluminum-skinned trailer is air conditioned

UNDER a new plan, offered by Dresser Electronics, Houston, Texas, a process dynamics trailer can be leased for as short a time as three months. The trailer contains electronic equipment needed for making a continuous recording of process variables such as pressure, temperature or chemical composition.

The leasing plan makes it possible for a plant to evaluate its need for a computer at a nominal cost. Hence, the possibility of computer control will be brought to many plants which heretofore have found it too expensive to obtain the data necessary to ascertain the potential value a computer might bring to a process.

Of course, even if it is found that a computer is not the best solution to process control of an individual operation, recording and evaluation of the data can often result in an improvement in the process. In some cases, desirability of process changes will become evident. In other instances, a need for replacing older equipment will be uncovered.

The mobile trailer contains equipment for recording process variables on either magnetic tape or paper tape. Information is recorded ready for direct entry into a general-purpose, high-speed digital computer for analysis.

To keep process instrument changes to a minimum during the period of data taking, the portable trailer is moved as close to the site as possible. Input signal-conditioning circuits are provided for almost every normal transducer or analyzer.

Variations Are Normal Or Induced

Often data is recorded following a normal process upset or a "step" input change. For some processes, however, insufficient accuracy — especially for transient-state phenomena — results from an abrupt variable change unless it is of very large magnitude. A large, rapid change may force the process out of its normal operating range with spurious analysis resulting.

One means of overcoming these difficulties is to provide a less abrupt parameter change of known amplitude and phase. If such an introduced control action is of sinusoidal form, mathematical techniques of analysis often become simplified.

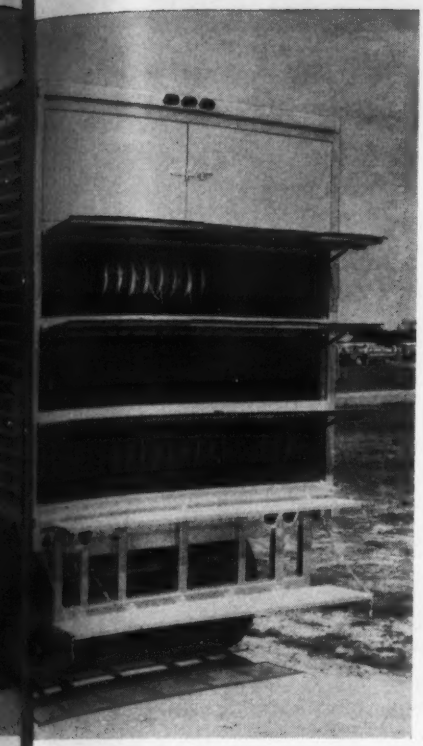
For the reason, the trailer is equipped with a low-frequency function generator. The unit is built around a high-speed digital-to-analog converter fed from a preset series of pulses or increments. Sinusoids with accuracies of 0.1% and periods as long as 24 hours can be derived from the generator, if desired. The incremental function generator has not been used on any of the trailers that have been built so far.

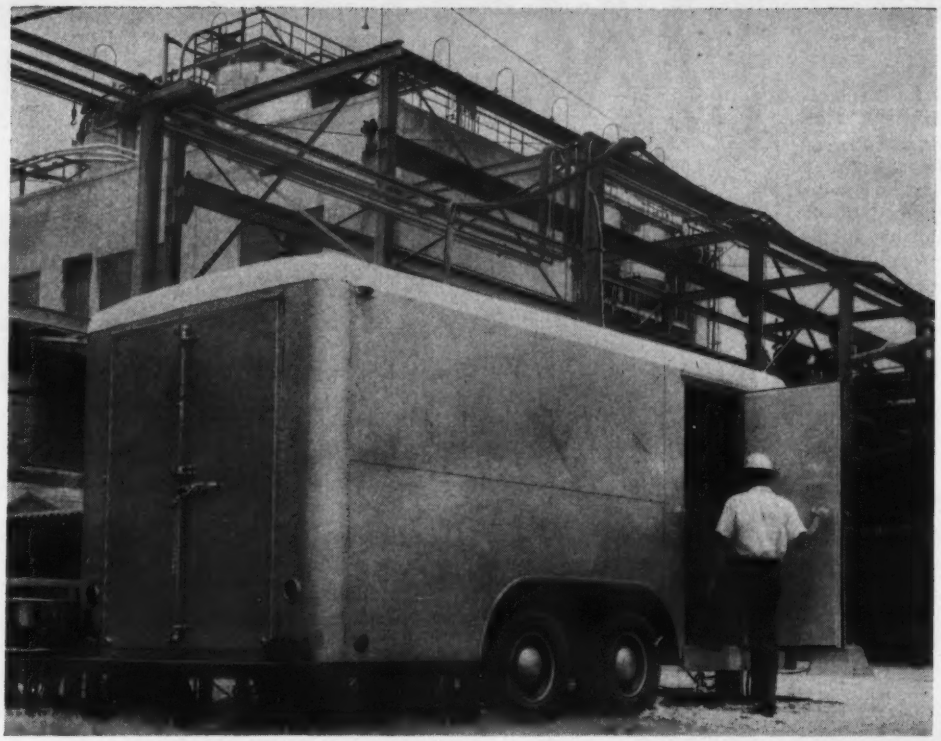
Purchase Still Possible

Since the lease plan was just recently made available, trailers built in the past were purchased outright by companies who desired to use them. Of course, trailers can still be purchased instead of leased, if desired. Cost varies from $60,000 to $120,000, depending upon particular equipment in a given trailer.

Leasing terms will be determined by prorating unit selling prices over a period that would be considered normal payout time. Exact terms would depend on type and complexity of equipment required, based on the minimum leasing time of three months.

The first trailer, delivered to Monsanto Chemical Company





Monsanto's *mobile data logger in use at Texas City, Texas, is helping to improve process controls. Trailer can be moved to various units within the plant and tied into process streams. Measurement of pressure, temperature or chemical composition are converted into digital signals and recorded on magnetic tape. Tapes are analyzed on company's computer in St. Louis*

at Texas City, Texas, in mid-1960, provides for six channels of recording on magnetic tape. Data are recorded in code at rates of 40, 4 or 0.4 six-trace records per second. Up to 60 inputs can be accepted five at a time. Solid-state circuits are used for all logic elements with mercury-wetted relays switching inputs for the 12 x 5 matrix.

Signal-conditioning circuits prepare dc millivolt transducer inputs for feed to the a-to-d converter. DC power supplies are available for up to 30 bridge-type transducers. Reference-junction compensation is provided for iron-constantan and chromel-alumel thermocouple inputs. Complete freedom of the logging sequence is furnished by input patch panels.

Spurious noises in the input signals may be reduced by specially designed active low-pass filters. At one-half the cutoff frequency, these filters' outputs are within 1½% of dc values. Attenuation is 3 to 6 db cutoff frequency and greater than 40 db at frequencies above twice the cutoff frequency. Cutoff frequencies provided are at 10, 1 or 0.1 cps.

Each measurement is recorded — with 1% accuracy and 0.2% reproducibility — as a three-digit number representing percent of full scale. Before final analysis can be made it is necessary to convert this number into a meaningful process unit.

Data recorded at Monsanto's Texas City plant is processed on the company's general-purpose computer in St. Louis, Mo. It can be advantageous to have a small computer in the trailer to edit the data as it is collected, save time and improve efficiency. If data collection and data processing are kept together, process can be better controlled.

In the case of one trailer now completed for Shell Chemical Company, such preliminary data preparation will be performed by a small digital computer mounted in the recording trailer.

Another feature of this trailer is the means provided for transducer connections. Three rows of cable reels will allow the input circuits to be connected very rapidly. Then, when the trailer is to be moved to another location, each input cable is simply unplugged and reeled, ready for immediate reuse.

In addition to the units made for Monsanto and Shell, some other companies are using data recording trailers which they built themselves. Phillips Petroleum has such a trailer. Previously, Imperial Chemical Industries in Great Britian built one, although it was designed for steady-state condi-

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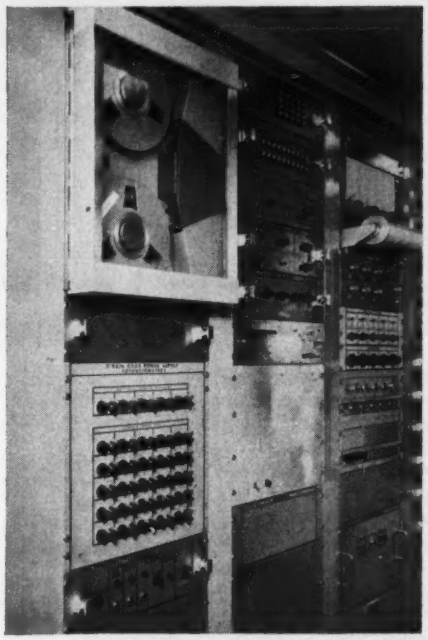


Internal *view of data-logging trailer at Monsanto. Magnetic-tape deck is at left, with "command" panel adjacent to it. Six-channel strip chart at upper right may be used to follow analog inputs when desired*

tions rather than the dynamic relationship. Shell, too, built one several years ago.

It is widely believed that it is more economical for a company to have a trailer built by a company specializing in the field and then to buy or lease it.

While results from the use of Dresser portable recording units are not available as yet, users indicate that they expect to find a wide range of control sophistication indicated — instances both of where complex process control can be justified and other cases where only simple regulators will be sufficient. Dresser also makes an analog control computer in the $5000-$10,000 price range and expects users to find some cases where devices of this type will provide the optimum control sought.

Technical Service

Towards the end of assisting customers with dynamic control problems, Dresser has employed an independent research firm for process analysis aside from work being done with the trailers. Studies and development by this group with regard to distillation-column control based on definitive dynamic and steady-state mathematical equations is expected to reach fruition in the near future. Other outside consulting companies have familiarized themselves with the use of Dresser trailers; they are available for leasing customers who desire their services.

The signal-handling techniques employed in the recording trailers are also directly applicable to input and output requirements for use with digital computers for process control. In order to make the equipment compatible with such digital equipment on an economic as well as on a technical basis, Dresser recently announced lease terms for this application as well as for the trailer-mounted units.

(For further information on data-recording trailers contact Dresser Electronics, PO Box 22187, Houston 27, Texas.)

Check 1137 opposite last page.

▸ A NEW SOLUTIONS FEATURE

Polyethylene Buechner handles corrosives at Morton Chemical

Provides low cost solution to filtering needs

Problem: Standard glass receivers, funnels and other lab items were not manufactured in large enough sizes to handle research requirements at Morton Chemical Company's Woodstock, Illinois, research laboratory. Experiments called for a Buechner funnel capable of filtering 50 to 100 gal of corrosive slurries such as sulfuric and hydrochloric acids.

Solution: Chemically inert linear, high density polyethylene was fabricated into a funnel and receiver. Cone support plate is ½" thick material with ribbing to add additional support when vacuum is applied. Filter plate is 1" thick with ½" holes on 1" centers. Receiver is 36" ID x 30" high and ¼" thick.

Filter handles corrosive slurries in 50 to 100 gal batches

Results: Durable unit efficiently handles required quantities of variety of concentrated corrosives. Individual components are light in weight and easy to clean. Cost was much less than the production-sized rubber or glass fabrications that would have been required.

(Polyethylene Buechner funnel is a product of American Agile Corp., PO Box 168, Bedford, Ohio.)

Check 1139 opposite last page.

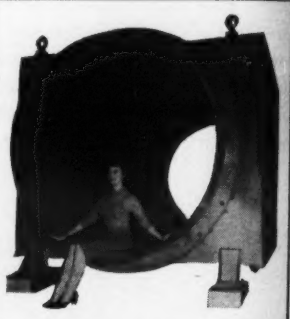
Only one opening given by burrette to atmosphere

A recently developed automatic burette has only one opening to the atmosphere. This prohibits liquid from preceding zeroing operation to remain in overflow cup. (Slight vacuum, created by previous discharge, automatically pulls it up into reservoir . . . which is reason reservoir can be completely emptied.)

Stopcock has Teflon plug of exaggerated taper. Plug also has bore permitting flow to be controlled over wide range. Burette is available in six different sizes.

(McCloskey Burrette is product of Scientific Glass Apparatus Company, Incorporated, Bloomfield, New Jersey.)

Check 1141 opposite last page.



Mighty water meter,

. . . largest magnetic flow meter ever manufactured, will measure quantity of water being pumped from Union Carbide Chemical Company's, Seadrift, Texas, cooling water basins. Seven-ton giant has a 78-inch diameter metering tube of stainless steel lined with Neoprene.

Meter has a flow capacity of 450,000 gpm, yet boasts a measuring accuracy within one percent. Despite vast size, meter draws only 35 amp on 110 volts AC.

(Magnetic flowmeter is a product of Fischer & Porter Co., 904 Jacksonville Road, Warminster, Pa.)

Check 1142 opp. last page.

Packaged heater melts costs in pilot processing

Providing flexibility, mobile electric unit also cuts installation, operating, maintenance costs at Union Carbide Plastics research lab

THE CONSTANTLY changing nature of a lab-scale pilot-plant research effort is enough to give ulcers to those who must plan for future needs. Flexibility is therefore a sought-after quality in equipment to be employed in operations such as those at the Research Laboratories of Union Carbide Plastics Company, Bound Brook, N.J.

A NEW SOLUTIONS FEATURE

It is for this reason that a 40-kw packaged mobile electric-resistance heating unit has met with great favor there. The heater is being used to supply liquid and vapor Dowtherm-A heat-transfer medium to jacketed pilot-scale process equipment. This equipment is used in connection with experimental production and process development on new polymer systems.

The entire heating system is mounted on a 5 x 9′ frame and can be moved from one lab location to another. For example, the heating unit connected to a 35-gal jacketed autoclave may be used to produce enough of a new product by a batch process for laboratory evaluation. Subsequently, the heater can be utilized to serve lab-scale pilot-plant apparatus in order to define a continuous process for commercial production of the same product.

Formerly, such heating requirements were handled by a Dowtherm vapor generated by a gas-fired installation (located externally) and by circulation of hot oil. The electric system not only has proved more flexible than its predecessors, but also has resulted in installation, operating and

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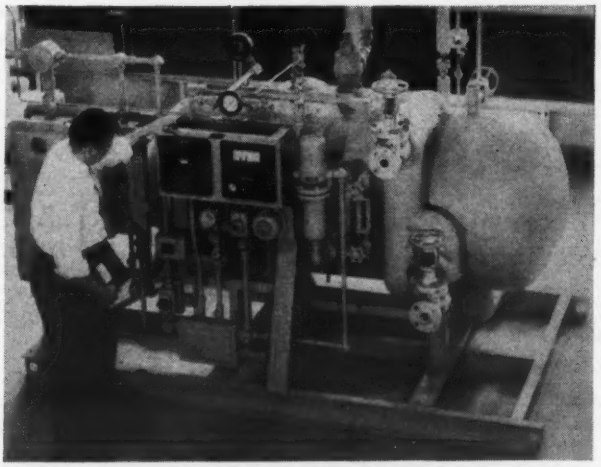


Electric-heating unit is mounted on 5 x 9′ frame and can be easily moved from one location to another

maintenance cost savings.

In contrast with the permanent original set-up, the heat source is now located near the equipment to be heated. This reduces operating expenses by conserving heat. In addition, such nearness minimizes the amount of pipe which must be installed for a given installation. With hot-oil circulation, the operating temperatures were in a range which resulted in excessive breakdown and sludge formation.

How It Heats

The electric system operates at 750°F and 150 psi to provide heat to process at temperatures ranging from 500 to 707°F. A built-in Hartford loop connects the vapor outlet and the condensate inlet. The condensate return connects with loop at the lowest permissible vaporizer level.

Vacuum in heated equipment pulls condensate from vaporizer down to the level of this connection. Vapor then drawn back through the condensate return line gives a water-hammer warning of low liquid level in the vaporizer. Liquid is made available for use simultaneously with vapor at controlled temperatures up to vapor temperature.

The electric-heating elements can be pulled out without draining the system. Each element is a unit assembly of resistor, insulated supports and terminals. For the 750°F operation, a 1½-hp canned pump with integral motor forces heat-transfer liquid through the jacketed pipe at 10 gpm and 100′ head.

Liquid temperature is controlled by a pneumatic indicating instrument with a 0-800°F thermal system. A three-way pneumatically operated control valve is used to blend returning Dowtherm liquid with supply liquid to attain proper operating temperature. Power supply is 440v, three-phase 60-cy.

(Packaged electric-heating unit is product of Hynes Electric Heating Division, Turbine Equipment Company, Mountainside, N.J.)

Check 1146 opposite last page.

THAT'S INTERESTING

Compound mends dents

Epoxy-metal compound designed to fill, bond and repair steel, iron, aluminum, bronze, brass, lead, tiles, concrete, brick, marble, glass, etc., is being introduced by Borden Chemical Company.

Two-part system consists of metal-filled resin and hardener. It sets in 2 to 4 hr at room temp; cures overnight.

Well-oiled mice live

Injections of olive oil double the survival rate of mice exposed to mid-lethal x-rays, an AEC-sponsored experiment reveals.

While the treatments, given before and after exposure with equivalent effects, facilitate recovery, they did not reverse radiation damage.

For more information on product at right, specify 1147 see information request blank opposite last page.

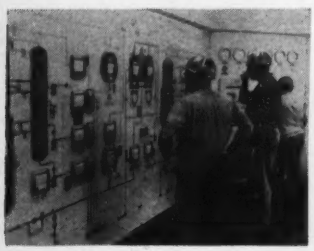
▶ A NEW SOLUTIONS ARTICLE

Crude-oil distillation unit at American Oil Co. goes closed-loop

System had been running under open-loop control

The American Oil Company has just gone to closed-loop control on its former open-loop-controlled 140,000-bbl/day crude-oil distillation unit at its Whiting, Indiana, refinery.

This crude still for the last year has been connected by a process-monitoring system



Operators monitor master control panel for world's largest crude-oil distillation unit at Whiting, Indiana, refinery of American Oil Company. This still has recently gone under closed-loop computer control

to an IBM-704 computer in the American Oil Technical Computing Center more than a mile away. (See "Standard Oil's giant crude still is tied into open-loop control with general-purpose computer," January 1961 CP, p. 56.)

The distillation unit will be under continuous computer control with the new system, around-the-clock seven-days per week, instead of under periodic guidance with the 704 system (which was timed-shared with technical-computing problems).

The new control system is an integrated operation for scanning process instruments and computing immediate as well as optimum operating conditions. It will continuously adjust instruments in closed-loop control to maintain optimum operations as process conditions vary.

This computer installation is part of a three-pronged computer-control program being

carried out by American Oil. The second installation at Whiting will be on an Ultraformer. The third venture is a feasibility study on an on-line real-time guidance system for the company's 145,000-bbl/day Texas City, Texas, refinery.

(Additional information on closed-loop computer control may be obtained from Data Processing Division, International Business Machines Corporation, White Plains, N.Y.)

Check 1149 opposite last page.

Simple unit measures low temp difference

Uses: Measuring low temperature differences such as wet and dry bulb temperatures, temperature rise across a pump or air heater efficiency.

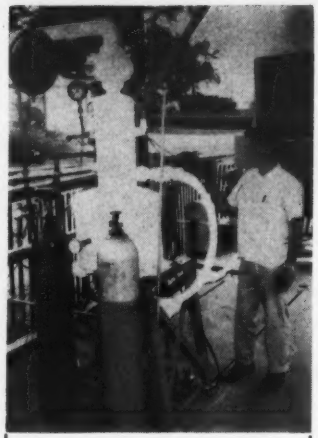
Features: Instrument eliminates need for a complex expensive pre-amplifier.

Description: Utilizing company's PowrLog recorder for amplifying and recording, instrument comes in two standard assemblies. One is adjustable for a temperature difference range of 15 to 25°F; second for a range of 50 to 200°F.

(Low temperature measuring instrument is a product of Hagan Chemicals & Controls, Inc., Hagan Center, Pittsburgh 30, Pa.)

Check 1150 opposite last page.

"Okay—now try 'er ——"



Cryogenic ball valve

. . . will be used for control of liquid hydrogen at −423°F in a rocket test stand. The 10″ automatically operated valve is shown here being tested with liquid nitrogen. On-off control is provided by a double-acting piston actuator which can be powered by hydrogen, helium or nitrogen at 1500-3000 psi. Valve has switch for remote indication of valve position.

(Fisher-Vickery ball valve is product of Fisher Governor Company, Marshalltown, Iowa.)

Check 1152 opposite last page.

Triple-threat digital unit indicates-records-controls

Uses: Measurement and recording of peak times and peak areas in chromatographic analysis.

Features: Integrator-recorder-controller accepts output signal from wide variety of analytical-instrumentation detectors and converts it to digital recordings of both time of occurrence and relative area of signal peaks. Digital values of peak times and areas may be recorded in any of common formats—digital printer or typewriter, punched cards or paper tape, or digital magnetic recorder.

Description: Integration is performed by unit digitally by automatic means. The control unit, with solid state circuitry, senses start and end of data-output signal peaks, and also the instant of maximum peak signal. Logic circuits program the application of integral and peak time values to recording equipment.

(CRS-1 digital integrator-recorder-controller is fully specified in CRS-1 Product Data Sheet—The Infotronics Corporation, 1401 South Post Oak Road, Houston 27, Texas.)

Check 1153 opposite last page.

Solution, slurry densities told without contact

Uses: Continuous measurement of density of a solution or slurry.

Features: Density is measured directly in process pipe without contacting material and without moving parts.

Description: Liquid density gages are accurate to within ± 0.0001 specific-gravity units.

Measurements are performed through use of cesium-137 source in measuring head. Gamma rays produced by source pass through measured material at a rate which is inversely related to density.

Gamma rays which pass through material are detected by radiation chamber and are converted into measurement signal. Special collimated source holder is utilized which provides narrow-beam geometry.

(Qualicon liquid-density gages are considered in six-page Qualicon Bul—Nuclear-Chicago Corporation, 333 E. Howard Ave., Des Plaines, Ill.)

Check 1154 opposite last page.

Closed-circuit television at home movie cost

Uses: Camera was primarily designed for applications in industry and business for security surveillance, process control or as a visual teaching aid.

Features: Completely transistorized circuitry provides high definition pictures with good contrast characteristics. Total cost for closed-circuit

television set up is near that of home movie equipment.

Description: Camera is self-contained with a power cord for attachment to an AC outlet and a coaxial connector for attachment to standard

Low-priced camera permits inexpensive closed-circuit television

television receiver. Three-lens kit provides a focusing mount, one-inch F 1.9 lens as well as telephoto and wide angle lens. Weight is 7½ pounds.

(Tel-Eye camera is a product of Allen B. Du Mont Laboratories, Division of Fairchild Camera and Instrument Corp., 750 Bloomfield, Clifton, N.J.)

Check 1155 opposite last page.

Tiny sensors

. . . are germanium semi-conductors, which will measure cryogenic temperatures from 4 to 40°K. Sensor at left measures surface temperature while the other device is a probe unit for internal applications. They can be used with conventional millivolt instruments.

(Germanium temperature sensors are product of Minneapolis-Honeywell Regulator Company, Wayne & Windrim Ave., Philadelphia, Pa.)

Check 1156 opposite last page.

Provides direct reading and control of any up-down operation

Add-substract controllers provide direct reading numerical indication of bi-directional counting or measuring operations. Instrument actuates machine control functions automatically when preset numbers are reached. Virtually any "up or down" counting or measuring operation can be controlled.

Controller adds or substracts when pulses from a transducer or sensing device are applied on two lines, one for add and one for substract. When successive preset numbers are reached, control functions are performed. Numbers may be set up by panel knobs, or remotely by punched tape, magnetic tape or punched cards.

(Add-Substract controllers are product of Dynapar Corp., subsidiary of The Louis Allis Co., 427 E. Stewart St., Milwaukee 1, Wis.)

Check 1159 opposite last page.

Completely self-contained rotameter-controllers, ready for the line

Uses: For purge and other flow control and indication applications.

Features: Instruments are completely self-contained. Because of unit construction, all external piping has been eliminated. Unit is ready for the line.

Description: Designated as Series 8800, a single unit includes rotameter mounted on a needle-valve-operated flow controller. Rotameter-controllers are available in several sizes ranging in flow applications from 0.01 gph (water) or 0.2 scfh (air) to 12 gpm or 48 scfm. Diaphrams can be furnished in any of several material combinations. Pressure rating depends on materials of construction; 250 psig for brass models; 500 psig for 316 stainless steel modes.

(Series 8800 controllers are products of Brooks Instrument Co., Inc., Hatfield, Pa.)

Check 1160 opposite last page.

NEW LITERATURE

Process Instrumentation and Laboratory Apparatus

Flow switches and other controls, such as vacuum switches, low-pressure switches, flow meters, manometers, air filter gages, are summarized in 30-page Controls Cat — The Henry G. Dietz Company, Inc.

Check 1162 opposite last page.

Digital computers are covered in introductory book which includes extensive listing of computer literature and books available. Copies of Government Research Report PB 171100, "An Introduction to Digital Computers," may be obtained at $1.25/copy from Superintendent of Documents, U.S. Government Printing, Office Washington 25, D. C.

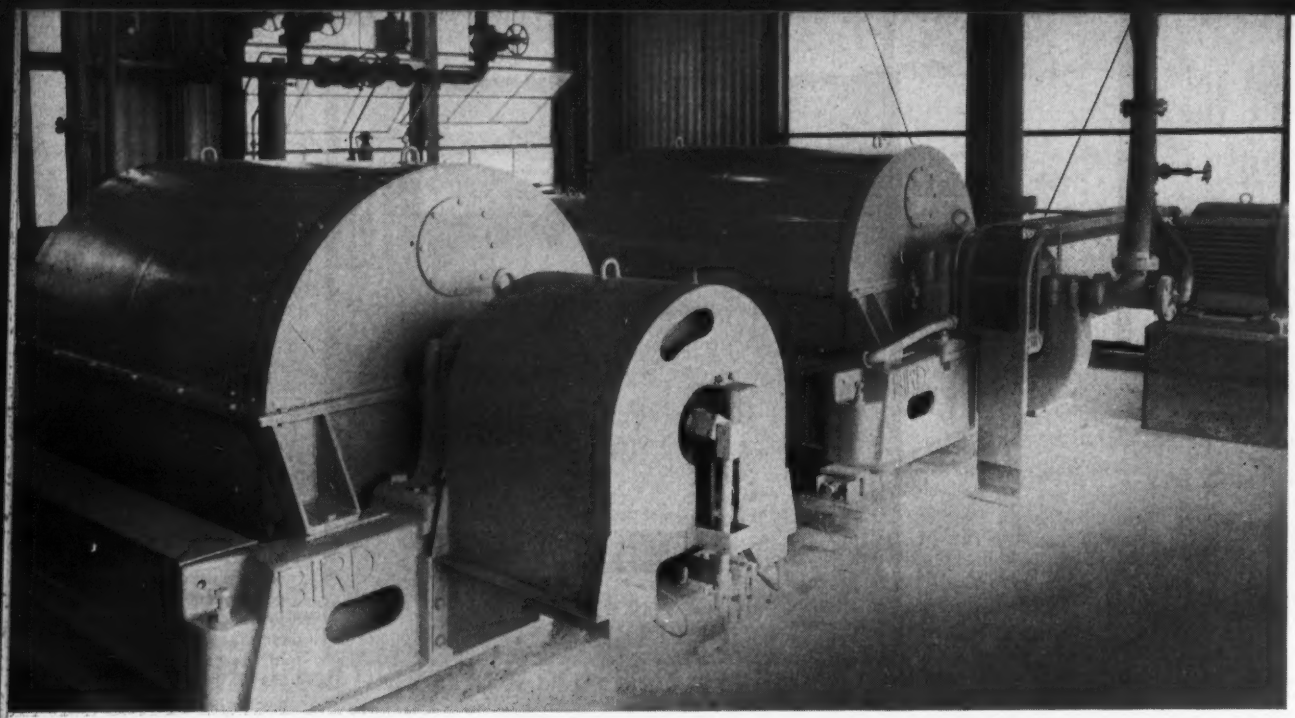
Flowmeters are topic of 170-page book which is 3rd edition of the work. Latest version has basic flow calculations rearranged for easy reference and expanded to include primary measuring devices other than orifice plates. Also included are schematic diagrams, graphs, charts, tables and other data.

Chapters are included on steam, liquid and gas flow calculations . . . each with necessary data to calculate or check orifice-plate installations. Copies of "Flow Meter Engineering Handbook" may be obtained at $7.50 each from Brown Instruments Division, Mail Station 0280, Minneapolis-Honeywell Regulator Company, Wayne & Windrim Avenues, Philadelphia 44, Pa.

Gages for pressure, vacuum and compound indication are illustrated and construction features and operations discussed in 32-page Cat DH-54 — Helicoid Gage Division, American Chain & Cable Company, Inc.

Check 1163 opposite last page.

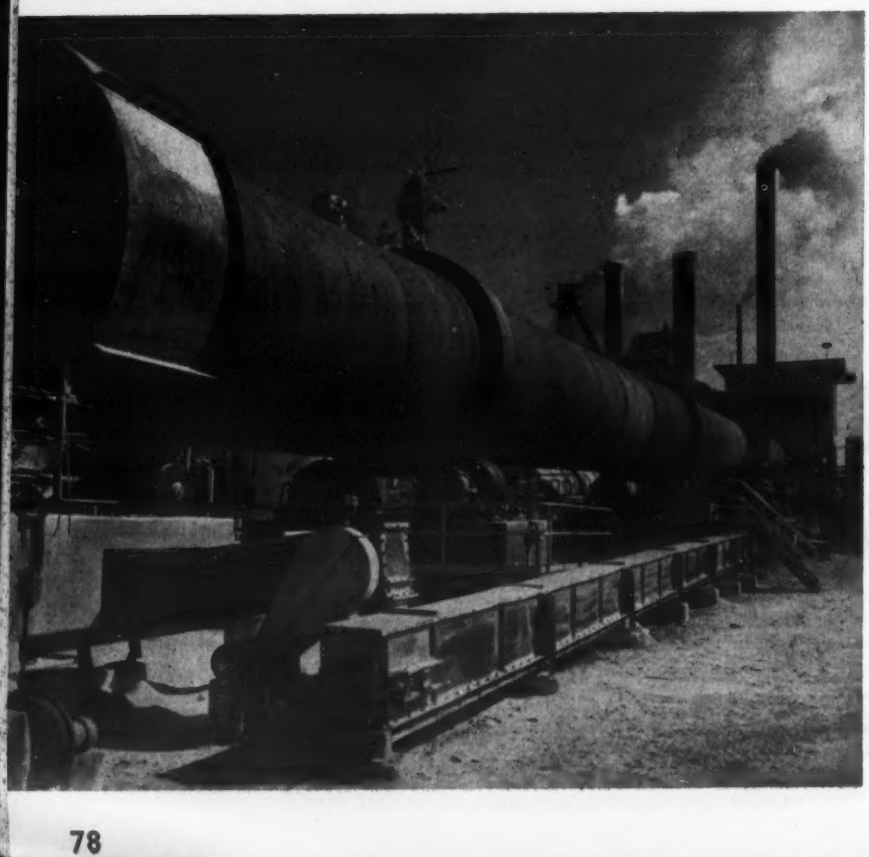
Infrared spectroscopy's role in analysis of paints and coatings is subject of 160-page manual. It explains basic concepts of theory, sample preparation and qualitative and quantitative spectra analysis. Manual also includes 259-reference bibliography and largest single library of spectra related to this field available in any technical manual today. Price schedule is $2.75 (single copies), $2.50 (5-24 copies), $2.25 (25-49 copies), $2.00 (50-99 copies), $1.75 (100 or more copies). Copies of "Infrared Spectroscopy—Its use as an Analytical Tool in the Field of Paints and Coatings" may be obtained from Infrared Spectroscopy Committee, Chicago Society for Paint Technology, 1350 S. Kostner Avenue, Chicago 23, Illinois.



Two centrifugal filters *receive controlled-density calcium carbonate slurry from tray thickener*

$CaCO_3$ burning costs

Lime kiln, *11′ 6″ diam by 275′ long, follows the filters. Heat efficiency has been greatly improved by new processing system*



A NEW SOLUTIONS FEATURE

Problem: In the filtration of calcium carbonate, after a washing operation and before calcination, a number of hurdles were encountered at the Texas Division of The Champion Paper and Fibre Company, Pasadena, Texas.

Difficulties centered mainly around the rotary filters ahead of the lime kiln. The filters fed the kiln at a widely-fluctuating rate — causing "ring formations" in the kiln. Besides, the low solids content of the kiln feed, varying within a range of 55-60%, contributed strongly to inefficient kiln operations.

Since the filters were open and there were frequent spills in the filter house, housekeeping was a problem. Chemical-laden steam emanating from the open filters was corrosive and obnoxious. Consequently, maintenance costs were high.

Solution: Two 40″ x 60″ continuous centrifugal filters were installed; they operate in parallel. Each unit has a capacity of 200 tons per day of dry weight calcium carbonate. At the same time a new lime kiln was installed. It is 11′ 6″ in diam, 275′ long and is equipped with both a chain section and a cross heat exchanger. Combination of a new kiln and centrifugal filters greatly reduced the overall burning cost.

Feed to the centrifuge is a settled product from the tray thickener. The feed slurry enters through a stationary feed pipe and passes through the conveyor hub from which it is delivered to the revolving bowl. A screw conveyor rotates inside the bowl at a slightly slower speed, in the same direction of rotation.

Solids are steadily moved along by the conveyor as fast as deposited by centrifugal force and are carried above the level of the pool for a short period of time before leaving the bowl. Adjustable filtrate ports are located so that the pool of liquid in the bowl is maintained at the required depth.

Control room *centralizes remote instrumentation, control. Closed-circuit television monitors kiln interior*

cut 60%

Lowered moisture and increased solids content of lime mud from centrifugal filters, plus more efficient burning, combine to improve overall operation

Density of the feed from the tray to the centrifuge is controlled by means of a gamma-ray gage to 35% solids by weight. Actual discharge from the tray thickener is somewhat more than this, but the feed is diluted by adding water to maintain the 35% concentration. Additional water also has the benefit of reducing the soda content in the slurry and simultaneously the soda content in the centrifuged carbonate going to the kiln.

Feed slurry temperature is held at approximately 140°F. Generally speaking, maintenance of this higher temperature results in a dryer cake and clearer filtrate and, consequently, a better recovery.

Control of Particle Size Key Factor

Particle size is an important property in a centrifuging operation. Coarser mud, as precipitated, means lower cake moisture, clearer filtrate and higher machine capacity.

Poor settling of the lime sludge ($CaCO_3$) occurs at high causticizing efficiencies and high liquor concentrations. Generally, the lower the activity of the white liquor (within the control range), the less the excess lime in the white liquor and, hence, the faster the settling of the calcium carbonate. Kiln efficiency is balanced against the carry-through of the unconverted sodium carbonate in the white liquor. This, in turn, is the guide to control activity of the white liquor and an indication of particle size.

As mentioned, poor settling of sludge, which occurs at higher-causticizing efficiencies, reflects the activity of the white liquor. Since the analytical method to determine the amount of free lime in the sludge is quite lengthy, the white-liquor activity is used as the controlling point. Naturally, this is increased or decreased by the amount of unreacted $NaCO_3$ carried through the reaction stages.

Method of operation em-

To next page

ployed to control the activity of the white liquor is accomplished by varying the green liquor-lime ratio at the slacking operation. When white-liquor activity gets too high, lime is lost through the poor settling of sludge. Although a routine control check for particle size is not run, it has been found that particle size varies with activity of the white liquor.

Summing up, the lower white-liquor activity results in larger particles which settle faster, filter better and give increased kiln efficiency.

In the Pasadena operation, white-liquor activity is between 86-88%, making a good centrifuging product and a dry cake, low in Na_2O.

A central control panel is housed in a separate enclosure. Mounted on this panel board are the necessary instruments and control systems.

A closed-circuit television receiver, located in the control house, permits the operator to observe the interior of the kiln at all times.

Results: Discharge solids have been increased from a 55-60% range to an average of 65% solids by weight. This reduction in moisture content and more efficient burning operations have cut heat consumption approximately 60%.

Ring formations within the kiln have been reduced by the higher-solids content and a more constant-feed rate. Maintenance costs have also been reduced since the system was installed in late 1960.

Improved housekeeping has resulted inasmuch as the centrifugal filters are sealed units and are vented. Hence, there are no obnoxious odors or corrosive vapors to create a trouble spot in the filter house.

The centralized control room allows for easier operation.

(Bird centrifugal filter is a product of the Bird Machine Company, South Walpole, Massachusetts.)

Check 1167 opposite last page.

(Lime kiln is manufactured by F. L. Smidth & Co., 20 West 43rd Street, New York 36, New York.)

Check 1168 opposite last page.

Filter plates, frames coated with Penton made available

Resist corrosive chemicals up to 250°F

Uses: Filtering wide variety of corrosive chemicals at temperatures up to 250°F.

Features: Chlorinated polyether coating is applied by fluidized bed process, resulting in homogeneous, void-free corrosion-resistant surface.

Description: Filter press plates and frames coated with Penton (Hercules Powder Company tradename for chlorinated polyether) have excellent resistance to wide

Tests assure absence of voids or pinholes on Penton-coated filter plate. Practically any size plate or frame can be coated

range of chemicals including solutions containing free chlorine and HCl at temperatures up to 250°F.

Coating also has good physical properties and possesses low rate of creep at pressures up to 1000 psi. Latter is important for maintaining good filter media gasketing in plate and frame filter presses.

Coating is in same price range as conventional baked-on materials. Cost is also lower than hand-applied sheet linings.

(Filter press and frames are products of The D. R. Sperry & Company, Batavia, Illinois.)

Check 1170 opposite last page.

(Penton coatings are applied by The Polymer Corporation, 2140 N. Fairmount Ave., Reading, Pa.)

Check 1171 opposite last page.

VALVE TIPS:

Check 1173 opposite last page.

PROCESSING EQUIPMENT

Simply take blades off, agitator fits through 12"x16" manhole

Device bypasses need for removing reactor heads

Removable-blade agitators, designed to fit through 12"x 16" manholes, are simplifying maintenance on high-pressure reactors and other units where head removable is difficult. Blades on the agitator can be replaced without disturbing agitator shaft or drive.

The agitator eliminates the costly and difficult problem of replacing gasketing on large openings of high-pressure vessels. Where clamped-top reactors are used, the mixer can be removed without disturbing the clamps or the gasket assembly.

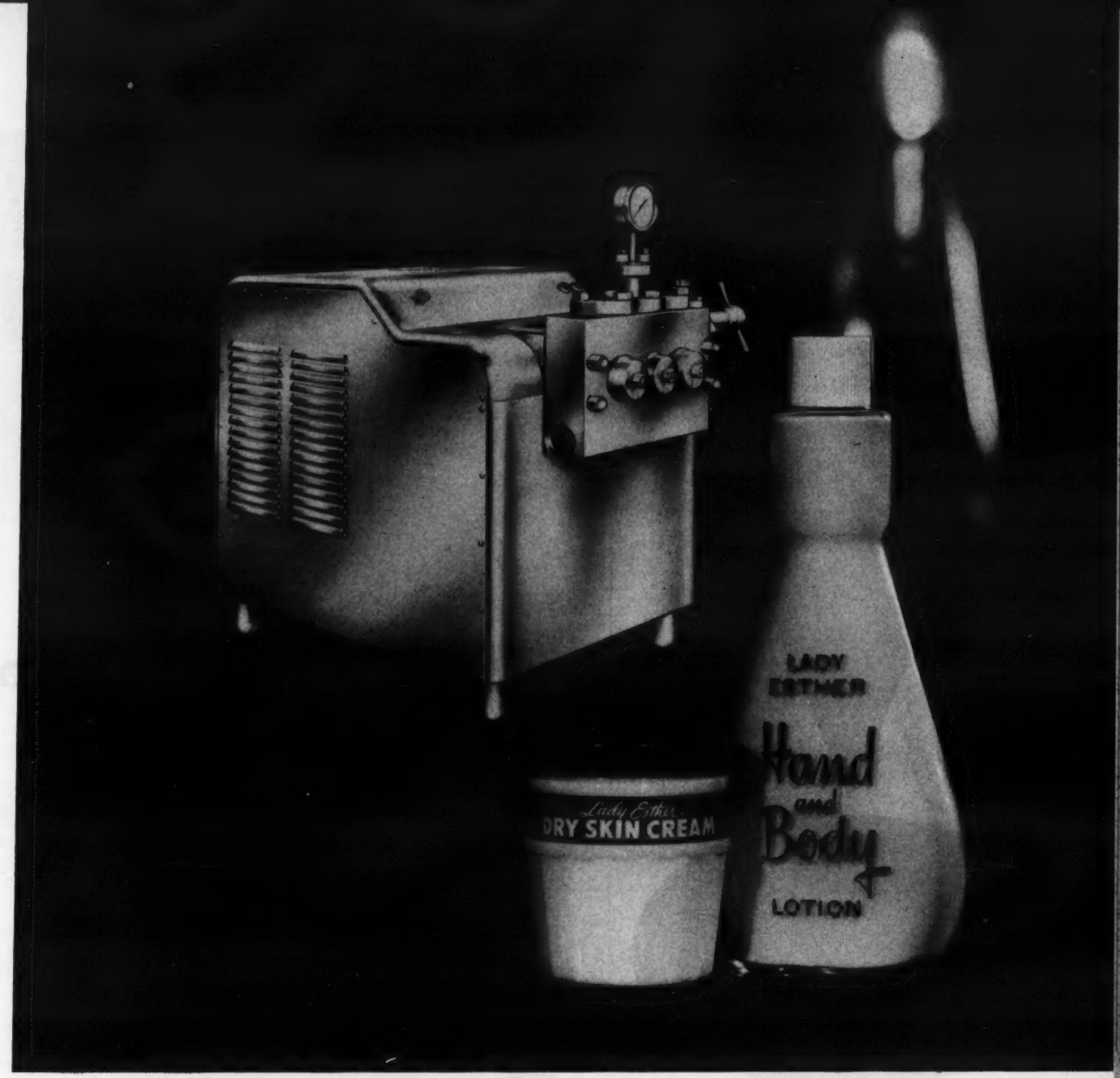
The agitator fits close to the bottom of vessels for maximum mixing efficiency. If a blade should ever become damaged during operation, only that portion of the three-blade assembly needs replacement.

(Further information about removable-blade agitators may be obtained from Glascote Products, Inc., a subsidiary of A. O. Smith Corporation, 20900 St. Clair Avenue, Cleveland 17, Ohio.)

Check 1174 opposite last page.

"Today, we'll take up the subject of 'buttering up'!"

Check 1175 opposite last page.



SUPERHOMO HOMOGENIZER MAKES COSMETIC CREAM SMOOTH AND EASY TO WEAR

Cherry-Burrell guards Lady Esther's quality

Lady Esther Dry Skin Cream and Hand and Body Lotion must be as smooth, as creamy, and as evenly textured as the skin it cares for. And the complexion — the nature — of Lady Esther creams is cared for by Cherry-Burrell homogenizers. They make sure it is evenly textured, intimately blended, and smooth enough to compliment the most delicate skin.

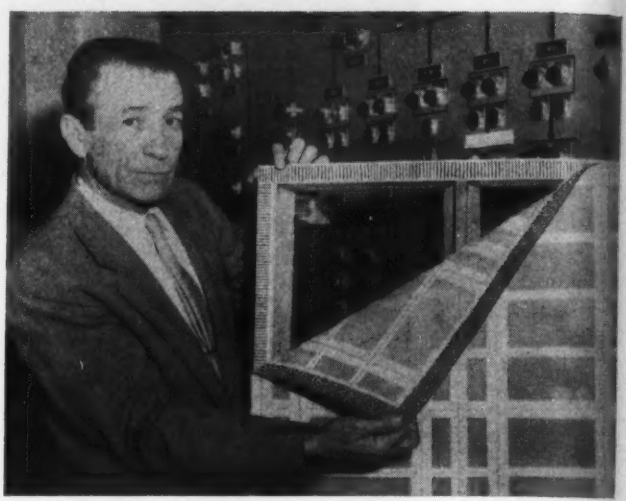
Cherry-Burrell homogenizers subject the cream to a strenuous shearing action. Explode it from 30 to 300 feet per second. And while increasing its velocity tenfold, change its direction abruptly 90°. The result: Lady Esther cosmetic creams and lotions that are so smooth and pleasant to use they generate repeat sales.

Highly trained technicians will test your product without obligation in a Cherry-Burrell laborâtory. They will show you how Cherry-Burrell processing equipment can help you improve your operation and profit position. Your specialists are invited to participate in the testing. Call or write Cherry-Burrell today.

For more information on product at right, specify 1176 see information request blank opposite last page.

EQUIPMENT FOR HOMOGENIZING, HEATING, COOLING, FLAVORIZING, STORING, SEPARATING, FREEZING, MIXING, PACKAGING AND CONVEYING. WRITE FOR YOUR FREE CATALOG.

CHERRY-BURRELL CORPORATION
CEDAR RAPIDS, IOWA

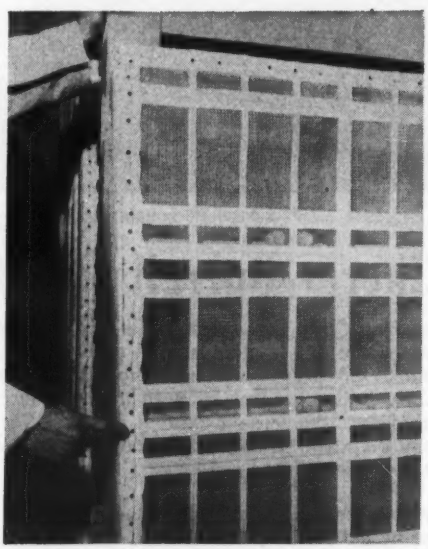


How tape permits screen cloth to be quickly peeled from frame is shown by G. Oteiza, superintendent of production at Refined Syrups & Sugars, Inc.

Substituting tape for tacks permits . . .

Two-minute screen changes on sifters

Simple fastening system reduces downtime, boosts efficiency of sifting operation in sugar mill



Conventional tacking method for fastening sifter screen cloth to frames made screen changeovers a time-consuming job

Problem: Switching screen cloths on giant vibrating sifters processing dry materials at Refined Syrups & Sugars, Inc., Yonkers, New York, was a slow and awkward operation. The conventional screen fastening method used on the units required the need of numerous tacks to attach the screen firmly to the frame of the sifter.

A NEW SOLUTIONS FEATURE

The threats of screen tearing, frame splintering and consequent product contamination were always present with the tacks. Spot inspections or quick changeovers were difficult to accomplish. To minimize production delays, it was necessary to maintain a large inventory of spare screens and frames at all times.

Solution: After 'round-the-clock testing for four months, the company replaced the tacks with an efficient tape-type fastening system. Using strips of hook- and loop-pile tapes, a workman can attach the screen cloths to the frames or remove them in an extremely short period of time.

The theory behind the technique is similar to that of a burr clinging to cloth. On every square inch of hook tape, there are hundreds of tough, semi-rigid nylon hooks that vigorously grasp the surfaces of the looped-pile tape. Because of efficient load distribution, the tapes have remarkable holding power, yet can be peeled apart and pressed together with ease.

Properly used, systems of this type reportedly can withstand more than 30,000 openings and closings. Tapes are also being used in aircraft, clothing, luggage and other heavy-duty industrial applications.

Adhesive Holds Tape To Frame

In mounting the tapes at Refined Syrups, a specially developed adhesive was first applied to the edges of the frame of the sifter. While the material was still tacky, a 1"-wide strip of hook tape was placed over it. Twenty-four hours were allowed for maximum adhesive cure. Simultaneously, a 1"-wide section of looped-pile tape was sewn to the sifter screen.

Results: The tape system now permits complete screen changeovers to be made in approximately two minutes. The method also assures more uniform screen tension, a condition which boosts the efficiency of the sifting operation.

Eliminating the tacks has simplified maintenance, quality control and substantially increased frame life.

(Further information about Velcro industrial fastener tape systems may be obtained from Velcro Sales Corporation, 681 Fifth Avenue, New York 22, New York.)

Check 1178 opposite last page.

For more information on developments reported in this section, check corresponding numbers on Reader Service Slip opposite last page of this issue.

Clogging resisted by plastic nozzles

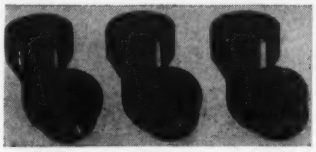
Start spraying below 2 psi

Uses: Spraying corrosive liquids in cooling towers, air washers, evaporative condensers and similar equipment.

Features: Nonporous plastic nozzles resist mineral buildup and withstand above-boiling and below-freezing water temperatures.

Description: Spray nozzles are injection-molded from low-friction, Tenite butyrate resin. Hollow cone spray design permits uniform spraying to begin at pressures below two psi.

Units are easily installed by hand. They can be cleaned with conventional materials. Low initial cost often makes



Plastic spray nozzles are easy to clean, have low initial cost

replacement more economical than cleaning. Nozzles are available in seven capacities ranging from 0.8 to seven gpm. Sizes are ⅜, ½ and ¾" diam.

(Butyrate spray nozzles are product of Austin Manufacturing Corporation, 1201 West 24th Street, Austin 5, Texas.)

Check 1181 opposite last page.

Plasma arc generator makes refractory spheres from powders

Unit can process over 10 pounds per hour

Uses: Spheroidizing refractory particles ranging in size from 100 to 150 microns with melting points in 2100 to 3200°C range.

Features: Unit is capable of processing over 10 lb of refractory powder per hour.

Description: Device can be used for making filtering units, compacting and sintering materials, and producing free-

flowing powders. Generator consists of four basic elements: A powder feed mechanism, an adjustable dual electrode plasma torch, quenching chamber and a gas-solids separator.

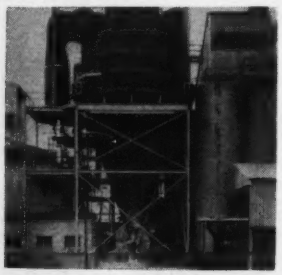
Bulk powder is fed into the machine axially, providing optimum particle dwell time and maximum flexibility. Material is spheroidized by simultaneously introducing dual plasma gas streams generated by passing inert gas through arc of a thoriated tungsten cathode-copper anode electrode combination.

High-velocity mixture discharged from plasma torch enters water-cooled quenching chamber through which multiple jets of gas are passed. Spheres are separated from the effluent gas by a conventional cyclone separator.

(Plasma arc generator is product of Plasmadyne Corporation, A Giannini Scientific Company, 3839 S. Main Street, Santa Ana, California.)

Check 1183 opposite last page.

▶ A NEW SOLUTIONS ARTICLE



An important step . . .

. . . in manufacturing sodium tripolyphosphate at American Agricultural Chemical Company is this big 26-ft diameter spray dryer. Installed at the firm's Carteret, New Jersey, works, unit measures 64 ft from chamber top to bottom. Adopting spray drying prior to calcining is reportedly resulting in the output of a more uniform, freer-flowing detergent-grade product.

(Spray dryer was produced by Bowen Engineering, Inc., North Branch, New Jersey.)

Check 1184 opposite last page.

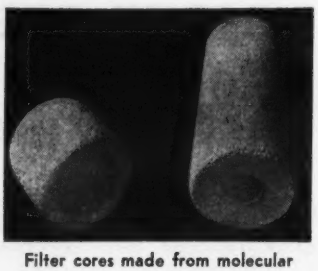
Gases filtered and dried with molecular sieve solid-core cartridges

Uses: Originally designed for filtering and drying refrigerants, units also hold promise for processing other liquids and gases.

Features: Molecular sieves in the form of solid cores, act as mechanical filters as well as desiccants. Units can remove particles down to 50 microns in size. Water adsorbent capacity is said to be 5 to 25 times that of conventional desiccants.

Description: Cores can be made in a variety of sizes and shapes. Pressure drop through a one-half inch section is under two psi (as measured with trichloroethylene at flow rate of five lb per square inch per minute).

Breaking strength is over 50 lb when activated and 25 lb when completely hydrated,



Filter cores made from molecular sieves are available in variety of sizes and shapes

as measured by Chatillon spring tester. Density of fully-activated cores is 55 lb per cu ft.

Because of the sieve's inherent selectivity based on molecular size, both refrigerant-12 and 22 (as well as lubricating oil) cannot enter adsorption cavity and do not interfere with water adsorption. This makes it possible to dry refrigerants down to five ppm at temperatures as high as 140°F.

(Solid cores made from Molecular Sieve Type-4A are manufactured by Linde Company, Division of Union Carbide Corporation, 270 Park Avenue, New York 17, N. Y.)

Check 1187 opposite last page.

Faster, finer grinding with tough, void-free, alumina-based balls

Cut feldspar grinding time from 48 to 24 hours

Uses: Grinding various products inside ball mills.

Features: Material provides faster, finer grinding results at less cost. White in color, the high-density balls are easy to clean and keep free of contaminants.

Description: Grinding medium is made of alumina-based material with a non-metallic bond of high strength and density. Product is available in six different sizes ranging from ¾″ to 2″ diam.

Isostatic pressing process used during manufacturing, insures uniform density. Absence of voids within the ball increases wear qualities.

In comparative performances, the alumina-based balls outperformed both procelain and flint grinding media. Processing time for 50 pounds of feldspar was cut in half — from 48 down to 24 hours.

(Starrlum #61 grinding medium is product of American Refractories & Crucible Corp., North Haven, Connecticut.)

Check 1190 opposite last page.

NEW LITERATURE

Processing Equipment

Portfolio of crusher and screen plant layouts is designed to assist engineers in making plant layouts. Measuring 9 x 11¾″, the book includes data for determining type and size of equipment. Drawings are scaled for use as templates. Crusher Portfolio — Allis-Chalmers Manufacturing Company.

Check 1191 opposite last page.

Horizontal hydraulic basket extractors designed to process granulated or flaked material is pictured and described in four-page brochure. Drawings show how unit operates. Bul 161 — The V. D. Anderson Company, division of International Basic Economy Corporation.

Check 1192 opposite last page.

To next page

PROCESSING EQUIPMENT

Paper stock processor — that pulps, defibers or refines — is summarized in four-page bulletin. Design permits all three functions to be performed in a single, compact machine. Extracta Pulper — The Noble & Wood Machine Company.

Check 1195 opposite last page.

Centrifugal separators for handling fine or coarse dusts are reviewed in 12-page brochure. Performance data and installation photos are included. Equipment comes in 20 different sizes and can handle air in volumes upward from 150 cfm. Bul E-221 — The Day Co.

Check 1196 opposite last page.

Twelve-page catalog discusses horizontal mixers for free-flowing and granular material. Design data are included for units ranging in capacity from ½ to 500 cu ft. Bul M/158A — Young Machinery Company, Inc.

Check 1197 opposite last page.

Impingement-type scrubbers for wet cleaning, absorption or cooling of gases are reviewed in four-page catalog. Cut-away shows flow through unit, which is available in capacities ranging from 1000 to 38,000 cfm. Cat 150 — The W. W. Sly Manufacturing Co.

Check 1198 opposite last page.

Advantages of side-entering agitators are explained in four-page bulletin. Three basic styles are shown. Photos and drawings illustrate major components. Bul 230 — Chemineer, Inc.

Check 1199 opposite last page.

Use of spray drying in the manufacture of catalysts at Girdler is reviewed in four-page reprint of technical article. The 10-ft diameter spray dryer used at the installation produces up to 300 lb per hour of solids. Reprint GC — Bowen Engineering, Inc.

Check 1200 opposite last page.

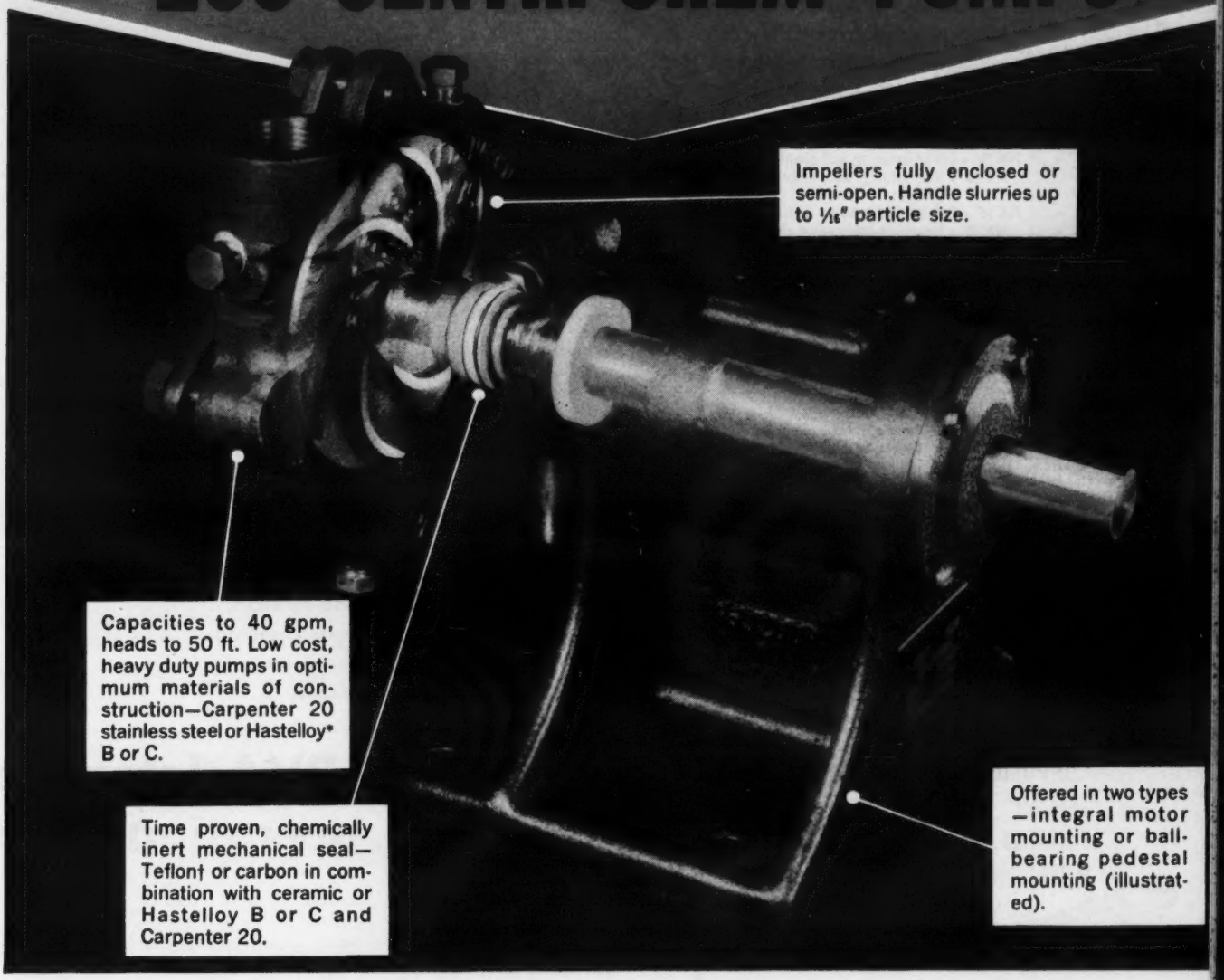
Conical blenders and vacuum dryers are pictured and described in page catalog. Specifications are listed for 36 units. Operating capacities range from 0.14 to 325 cu ft. Cat C-1 — Paul O. Abbe, Inc.

Check 1201 opposite last page.

Magnetic trap designed to separate tramp iron and other ferrous contaminants from materials conveyed through pipe lines, is described in two-page bulletin. Unit fits into two, three or four-inch lines. Bul 1910D-N — Dings Magnetic Separator Company.

Check 1202 opposite last page.

LOOK INTO...
ECO CENTRI-CHEM® PUMPS



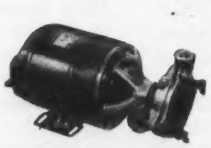
Write for Literature on any or all of the Eco stock pumps shown below for handling corrosive or hazardous processing fluids.

*Union Carbide Trademark. †du Pont Trademark.

ECO

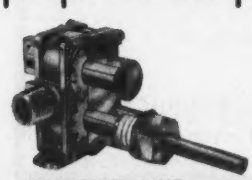
the big-name in small pumps for the process industries

For more information on product at right, specify 1205 see information request blank opposite last page.



CENTRI-CHEM LINE

ALL-CHEM LINE



GEARCHEM LINE

MINILAB LINE

ECO ENGINEERING COMPANY · 12 New York Avenue · NEWARK 1, N.J.

Translucent plastic tanks permit liquid level to be seen at all times, eliminating need for gaging.

Sturdy, cable-wrapped, "see-through" plastic tanks end tedious drum handling at Ferro Corporation. Corrosion-resistant, lightweight and economical units . . .

Speed PVA-latex handling, slash operating costs

TED F. MEINHOLD, Associate Editor
with **M. BOZSIN,** Chief Chemist
Ferro Corporation, Cleveland, Ohio

Problem: The practice of purchasing and using polyvinyl-acetate latex in 55-gallon drums was expensive, laborious and time-consuming at the Tennessee Fiber Glass plant of Ferro Corporation, Nashville, Tennessee. Not only was the cost of the material higher when bought by drum instead of by tank truck, but excessive handling was also required.

A NEW SOLUTIONS FEATURE

The filled containers — usually arriving in lots of 75 — had to be unloaded from the vehicle, moved to the warehouse and stacked to await use in the manufacturing area. About half the space in the warehouse was constantly occupied by drums.

They presented difficulties at the processing end too. Besides tying up floor space, each drum had to be opened, dumped and disposed of manually. Considerable losses in latex were experienced by this method.

The use of large steel storage tanks was considered, but dismissed as impractical. For one thing, both initial and installation costs would have been high. More important, however, was the nature of the material being handled.

The PVA latex has a tendency to "skin" on metallic surfaces, forming a thick, sticky residue. When present on walls of tanks, the skins would cause a constant maintenance "headache."

Sight-gage equipment would also have

been needed, entailing additional expense — not to mention cost of cleaning and maintaining the gages.

Solution: Translucent plastic tanks, reinforced with stainless-steel cable, provided the answer. The company installed two such units. Each measured five feet in diameter by 14 feet in height and weighed 575 pounds. This relative lightness permitted six North Tonawanda, New York, workmen to lift, without the use of chain falls or crane, the assembled tanks and ease them onto a 34-foot trailer for delivery to Nashville, Tennessee.

The principle of construction used on the tanks is similar to that on a suspension bridge. The cable is helically-wound on the exterior of the tank in order that most of the stresses are carried by the cable. This permits plastic tanks to be economically built of practically unlimited size with a high factor of safety.

The cable is bonded to the tank shell at intervals — so that even in the unlikely event that it might be cut, there would be no failure because the cable cannot unwind. By snubbing action, the remaining cable turns would pick up the load.

Glass-reinforced polyester resin, well-known for its corrosion resistance, light weight and strength, is used for the tank shell.

For larger tanks, tank segments are molded and shipped to the job site. By a cold-bond process, multiple segments are assembled to form tiers, and multiple tiers join to form a cylindrical wall. All parts can be moved through standard-sized doors, regardless of tank dimensions. This by-passes any need to break walls.

Results: The low-cost plastic tanks have eliminated the use of 55-gallon drums for supplying PVA latex at the plant. Ferro now buys the material in truckload quantities, thereby taking advantage of the lower bulk prices.

The actual handling of the chemical is no longer a slow, tedious and messy operation. Absence of the drums has cut

To next page

labor costs and has resulted in more efficient utilization of personnel.

Valuable floor space, previously occupied by the drums in the warehouse and manufacturing area, has been released for other use. The overall plant appearance has also improved.

The two plastic tanks, occupying a total of only 50 square feet of floor space, can store a total of 4112 gallons of product. The 14-foot height of the tanks provides ample head pressure for drawing off material.

"The non-stick," slippery characteristic of the polyester tank prevents "skinning" of the product on the walls. Because of the translucency of the plastic, liquid level in units can be seen at a glance, thereby avoiding the need for gaging equipment.

(Kabe-O-Rap tanks are manufactured by Metal-Cladding, Inc., 470 Niagara Parkway, North Tonawanda, New York.) Check 1210 opposite last page.

Westinghouse makes easier to weld stainless steel

Has application in −452°F to 1200°F range

Stainless steel that is simpler to weld has been developed for use at high and low temperatures. Strength and corrosion resistance of the alloy are reported to be equivalent to that of any AISI type-300 series stainless steels of similar alloy content.

The new metal can be used where weldability and strentgh at temperatures up to 1200°F are required and where large sections must be welded, such as in petroleum and chemical processing equipment. Thin sections like those used in vacuum systems can be welded by conventional fusion techniques.

Other applications look promising in the cryogenic field at temperatures down to −452°F.

In composition, the alloy consists of 16% chromium,

20% nickel, significant amounts of manganese and molybdenum, and smaller parts of silicon, carbon and other impurities, in addition to iron.

The alloy combines a 100% austenitic alloy with high ductility, crack-resistant welds and crack-free base metal. Weld deposits are as resistant to hot cracking as conventional stainless steel deposits with five to 10% delta ferrite. The fully austenitic weld deposit eliminates need for post-weld heat treatment.

(Further information about Kromarc-55 stainless steel may be obtained from Westinghouse Electric Corporation, Materials Manufacturing Department, P. O. Box 128, Blairsville, Pa.)

Check 1212 opposite last page.

Harsh acids, fumes at 250°F resisted by epoxy coating

Uses: Protecting metal, concrete and wood surfaces — either indoors or outdoors — from corrosive fumes and liquids.

Features: Polyamide modified epoxy resin provides protection up to 250°F.

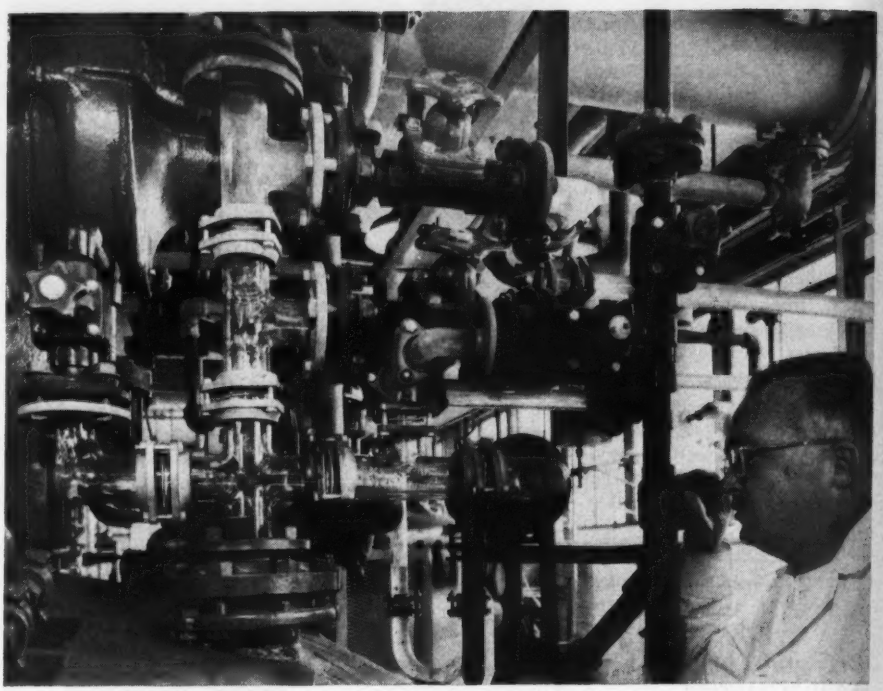
Description: Product is essentially non-toxic when fully cured. It is easily applied by brush, roller or spray. A two-component formulation, base and catalyst are combined at point of use.

(Acidex epoxy coating is manufactured by A. C. Horn Companies, Division of Sun Chemical Corporation, 550 Third St., San Francisco 7, Calif.)

Check 1213 opposite last page.

NEXT MONTH

Are corrosive conditions destroying electrical conduit and fittings in your plant? If so, be sure to read the article in the November issue about how Best Fertilizers Co. halted its problem with inexpensive plastic enclosures. Besides eliminating shutdowns, the plant expects to save $4000 per year in repairs.



A good way to handle corrosives at 400°F

Glass pipe simplifies maintenance, housekeeping and process control as it is used interchangeably among different processes at Hoffmann-La Roche

Problem: In the production of pharmaceuticals and vitamins, various hot, corrosive chemicals had to be handled by pipe — frequently under vacuum — at Hoffmann-La Roche, Inc., Nutley, New Jersey. Temperatures often were as high as 400°F.

A NEW SOLUTIONS FEATURE

Plastic and rubber pipe installed in the plant could not effectively withstand these conditions. Trouble was usually experienced when temperatures exceeded 120°F. If vacuum was applied some of the pipe even collapsed.

Solution: Glass pipe was installed in many phases of the manufacturing processes. Overall, several thousand linear feet of pipe and hundreds of 90° glass elbows and 45° bends were used.

Between 600 and 700 feet of pipe, ranging from one to two inches in diameter, were installed in one process alone. In a laboratory, a 120-foot-long line was hung to carry hydrochloric acid and solvent the entire length of the building.

A glass-blowing shop located on the plant's premises provided special pipe — such as pipe with unusual bends, twists or variances in diameter. For example, to connect a one-inch-diameter section to a three- or four-inch pipe, a standard length of one-inch glass pipe was blown "balloon-fashion" to the desired size.

Individual sections were joined together by the use of gaskets and conventional metal flanges and bolts. The method is quick and simple, requiring no special tools. It also permits portions of a line to be removed and replaced in a matter of minutes, if the need should arise.

Results: The glass pipe has provided the corrosion and heat resistance, strength and versatility required at the Hoffmann-La Roche installation. The pipe's trans-

parency has also simplified process and quality control — particularly when color-sensitive materials are being handled. Any clogging of lines can be readily seen.

The glass is expected to last indefinitely. Because its surface remains smooth and clean, the pipe can be salvaged or used interchangeably among different processes. The versatility and long life of the glass pipe were major points in justifying its somewhat higher initial cost over other materials at the pharmaceutical company.

Breakage has not been a problem. Similar glass pipe, installed in one of the laboratories, has suffered only one break in more than eight years of use. It occurred in an improperly supported line.

(Further information about Pyrex-brand glass pipe may be obtained from Corning Glass Works, Corning, N.Y.)

Check 1216 opposite last page.

Zinc coating dries within 15 minutes

Uses: Protecting surfaces against corrosive attack from organic or inorganic solvents, fresh or salt water, oils and greases.

Features: Sacrificial zinc coating dries within 15 minutes to a weather-resistant layer.

Description: Material consists of a modified lacquer base into which is blended metal zinc powder to form a solution of better than 57% total solids (by weight). Coating is self-curing and requires no other curing agent. A 2 to 3-mil thick film, obtained in a single application, provides excellent surface for topcoatings.

Product can be applied by brush or spray. Topcoats are not necessary for protection against solvents, water, oils or greases.

(Tyzin protective coating is product of Coatings and Linings Div., U.S. Stoneware, Akron 9.)

Check 1217 opposite last page.

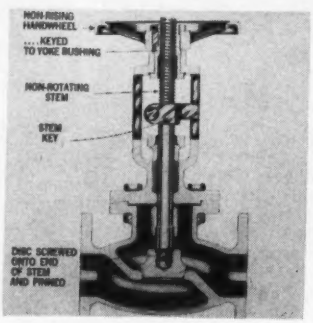
Globe valves redesigned for better control, longer life

Available in wide variety of corrosion-resistant alloys

Uses: Controlling flow of corrosive fluids in chemical and allied industries.

Features: Redesigned globe valves provide improved throttling control and eliminate disc vibration and chatter.

Description: Valves have non-rising handwheel and non-rotating stem with a non-rising handwheel and fixed disc instead of rotating stem with rising handwheel and swivel disc as found in conventional globe valves.



Globe valve has non-rising handwheel and non-rotating stem

Key Location

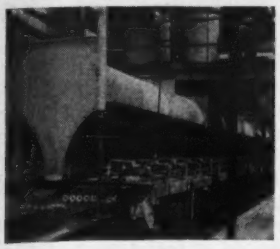
Key that prevents stem rotation is fitted into a slot in the bonnet yoke. Since stem key moves in relation to yoke, it is possible to calibrate the yoke in terms of degree of throttling desired. Tight closure is assured, permitting accurate regulation of flow, especially when high velocities are involved.

Valves are produced in 150-lb globe, angle and Y designs in 2" and larger sizes. All three types are available with renewable discs of Teflon or other suitable material. Valve construction includes 18-8S, 18-8SMo, Aloyco 20, Monel, nickel and Hastelloy B and C.

(Aloyco corrosion-resistant globe valves are product of Alloy Steel Products Co., 1300 W. Elizabeth Ave., Linden, N. J.)

Check 1220 opposite last page.

▶ NEW SOLUTIONS ARTICLE



Star performer . . .

. . . is this plastic ventilating system — serving wire-coating line at American Steel & Wire Division of U. S. Steel, Worcester, Mass. Two years of bombardment from HCl and H_2SO_4 have failed to affect the 150-ft long hoods and three 80-ft high towers, which exhaust fumes at rate of 70,000 cfm. The glass-fiber impregnated polyester resin equipment replaced wooden units which were unsatisfactory. Three plastic exhaust fans are also incorporated in the system.

(Plastic ventilating equipment was constructed by Beetle Plastics of Crompton & Knowles, Fall River, Mass.)

Check 1222 opposite last page.

Plastic pressure pipe withstands 100 psi and 250°F

Uses: Conveying various corrosive and noncorrosive solutions either above- or underground.

Features: Reinforced plastic pressure pipe is capable of withstanding pressures up to 100 psi at temperatures reaching 250°F.

Description: Plastic pipe is available in 10- and 20-ft lengths and is furnished in fiberglass mat and cloth construction. Wall thicknesses range from ¼ to 5/8 inch, depending upon specific application. Fittings such as elbows, tees and U-bends are also available.

(Duracor reinforced plastic pressure pipe is product of The Ceilcote Company, 4834 Ridge Road, Cleveland 9, Ohio.)

Check 1223 opposite last page.

Platinum helps prevent hydrogen embrittlement of tantalum

Purity, history, source and heat treatment have no apparent influence on the susceptibility of tantalum to hydrogen embrittlement in aggressive reducing aqueous acid media. However, contact of tantalum with an extremely small area of platinum appears to be an effective method for preventing embrittlement.

Tantalum is embrittled in a few hours in concentrated hydrochloric acid at 190°C. However, in a system with a tantalum to platinum area ratio of 10,000 to 1, tantalum is immune to embrittlement for more than 1000 hr. Corrosion rate of tantalum is not increased by such contact and in some cases actually decreases. Corrosion is reduced to a negligible value by contact with tantalum.

Other Metals Work Too

Platinum, palladium, gold, iridium, rhodium, osmium, ruthenium and rhenium are all effective in reducing hydrogen embrittlement of tantalum. Contact can be made by riveting or welding a small spot of these metals on the surface or by electrodeposition. Rubbing the surface with these metals is also an effective means of application. Because of its low hydrogen overvoltage, lower cost and excellent corrosion resistance, platinum seems to be most important in commercial use.

In boiling 85% sulfuric acid contact with platinum reduces the corrosion rate and prevents embrittlement of tantalum during an exposure of over 550 hrs, with an area ratio of tantalum to platinum of 1590 to 1.

Under practical operating conditions, tantalum can also become embrittled by being subjected to stray galvanic currents. For example, tantalum plugs are often used to seal holes in glass-lined vessels. If, during use, an additional hole is produced in the glass coating, galvanic couple is produced which causes a current flow. Laboratory tests in which tantalum has been made cathodic in sulfuric acid at current densities of 1 and 10 ma/cm², an area ratio of tantalum to platinum of 15 to 1 prevents embrittlement for 2 hrs. Current density of 10 ma/cm² is considerably higher than one would expect to find in actual operating systems.

Relatively simple method of preventing hydrogen embrittlement of tantalum should be of value in making equipment more versatile and capable of handling higher operating temperatures under corrosive conditions.

(Based on technical paper, "A Method for Prevention of Hydrogen Embrittlement of Tantalum in Aqueous Media," presented at 1961 meeting of NACE, Buffalo, N.Y., by Claude R. Bishop and Milton Stern, Metals Research Laboratories, Union Carbide Metals Company, Division of Union Carbide Corporation.)

(For further information on use of the tantalum, contact Union Carbide Metals Company, Division of Union Carbide Corporation, 270 Park Ave., New York 17, N.Y.)

Check 1226 opposite last page.

Polyethylene faucet

. . . for dispensing chemicals, detergents and waxes from drums resists corrosion and discoloration. Faucet may be easily adjusted to control flow of liquids from full flow to trickle. Features include a lip on the head which contacts a ridge on the faucet body to prevent over-tightening while molded skirt at the base allows the faucet to be tightened firmly in any position on the drum.

(Polyethylene drum faucet is made by Rieke Metal Products Corp., Auburn, Ind.)

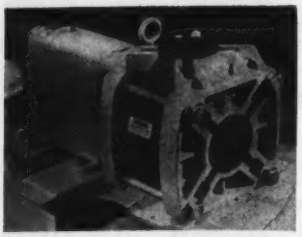
Check 1227 opposite last page.

Frame-mounted unit added to firm's line of graphite pumps

Uses: Pumping corrosive solutions in chemical and allied industries.

Features: Compact, frame-mounted pump made of impervious graphite, is designed for service under tough corrosive conditions.

Description: Unit is an expansion of manufacturer's line of impervious graphite pump. In extending the size range, the series supplements frame-



Impervious graphite pump is available with 1, 1½ and 2 inch discharge openings

mounted type-C unit previously available with discharge openings of 2, 3 and 4 inches. The new pump provides 1, 1½ and 2 inch discharge openings for greater installation flexibility.

(Further information about Type-F Karbate pumps may be obtained from National Carbon Company, Division of Union Carbide Corporation, 270 Park Avenue, New York 17, New York.)

Check 1228 opposite last page.

$NaVO_3$ in MEA halts corrosion in gas scrubbers

Tests show 0.05% concentration is adequate

Recent studies have shown that small concentrations of sodium metavanadate, $NaVO_3$, in MEA (monoethanolamine) solutions protects process pipe of gas scrubbing systems from corrosion. Chief use has been in MEA systems, but indica-

To next page

From preceding page

tions are that it also works in DEA and hot carbonate process systems.

Recommended concentration is 0.05% by weight. The addition of from 2 to 2½ times the calculated amount at startup assures a sufficient residual concentration. Excess use of $NaVO_3$ will not damage system. Tests after one year of service indicate that no decomposition occurs.

Easy To Use

The chemical dissolves readily in hot water, so it can be added directly to the amine solution. In use, it promotes formation of a tough, tenacious, impervious coating of magnetic iron oxide on walls of the gas scrubbing system.

Coating resists attack by acid gases or amine decomposition products. The iron capacity of the amine solution is lowered by residual vanadate contents to well under 0.05%.

(More information about use of sodium metavanadate as corrosion inhibitor may be obtained from Vanadium Corporation of America, 420 Lexington Avenue, New York 17, New York.)

Check 1231 opposite last page.

"This water is so hard, the best treatment would be to put it through a grinder!"

Idea by Walter H. Dittrich, Reichhold Chemical, Inc.

NEW LITERATURE

Corrosion Control

How to handle corrosive fumes is told in 36-page catalog. Complete details of company's line of unplasticized, PVC fans, air washers and exhaust systems are presented. Chemical-resistance data for normal and high-impact PVC are also given. Cat F — Industrial Plastics Fabricators, Inc.

Check 1234 opposite last page.

Metal treatment that conquers rust is explained in four-page folder. When applied directly on rusted metal, product halts oxidation and provides inert, hard surface ready for conventional paints. Ospho Folder — Rusticide Products Company.

Check 1235 opposite last page.

Resistance charts for five acid-proof cements are included in eight-page bulletin. Stability of furan, phenolic, sulfur and silicate cements in temperature range of 75 to 140°F are shown for over 90 corrosive agents. Ratings of asphalt compounds are presented for 75 chemicals. Bul No. 1 — Acid-Proof Cement Manufacturers Association.

Check 1236 opposite last page.

1962 Buyer's guide to equipment and services for handling and processing liquids and gases has been published by manufacturer. The 16-page book also discusses units made from corrosion-resistant materials such as glassed steel, stainless steel, titanium, zirconium, tantalum and other materials. Engineering data in chart and tabular form is included — Bul 1010 — The Pfaudler Company, division of Pfaudler Permutit Inc.

Check 1237 opposite last page.

Technical data for centrifugally-cast, thermoset, epoxy resin, glass-fiber reinforced pipe is presented in 16-page brochure. Tables, charts and graphs list chemical resistance, specifications and flow rates for tube and pipe. Bul "Fibercast — Tech and Spec Data" — Fibercast Company, division of The Youngstown Sheet and Tube Company.

Check 1238 opposite last page.

Maximum working pressures for PVC pipe at elevated temperature are given in charts shown in eight-page booklet. Also included is information on joining techniques, solving expansion and contraction problems and threading of unplasticized PVC pipe and fittings. Corrosion resistance to 352 elements and compounds is tabulated. PVC Pipe Booklet — Consolidated Pipe Company of America.

Check 1239 opposite last page.

Operator tucks *in valve sleeve of bag automatically filled and discharged to bag rest . . .*

Elbow release, *actuated by operator, drops filled bag to take-away conveyor . . .*

cp **MATERIAL HANDLING and PACKAGING**

Switch to valve bags, valve packer pays off in neater, trimmer package . . .

Carbon black bagging Zooms

Problem: Carbon black for domestic and export use was packaged in pasted open-mouth bags by United Carbon Company, Houston, Texas.

A NEW SOLUTIONS FEATURE

Since carbon black must be handled carefully to avoid product degradation, the bagged product was loosely packed and was therefore awkward to handle. The packaging operation was further complicated by the fact that density range varied. For example, semi-reinforcing furnace black varies from 38.5 to 31.5 lb/cu ft.

The bags had to be folded and taped individually, slowing the bagging rate to approximately 18.5 manhours per 1000 bags for domestic use, and 61.6 manhours per 1000 bags for export use.

Dust generated during the bagging operation complicated housekeeping and impaired the appearance of the package.

Solution: After investigating alternatives, United Carbon adopted a packaging and handling system keyed to a pneumatically-operated, two-tube valve-bag packer and, of course, utilizing valve bags.

Here is how it works. The operator slips an empty bag over the filling tube and strikes a button to start the filling cycle. The bag is filled and automatically discharged to a bag rest. The operator tucks in the valve sleeve to seal the bag and then actuates an elbow release to drop the bag to the take-away conveyor. The latter carries the bag over a Toledo checkweigher and through a special bag press where it is automatically shaped for better palletizing.

Off Weight Bags Rejected

The checkweigher records the number of bags packed and the bag weights within tolerance. It also signals when an underweight or overweight bag passes so that it is automatically rejected and the weight adjusted manually.

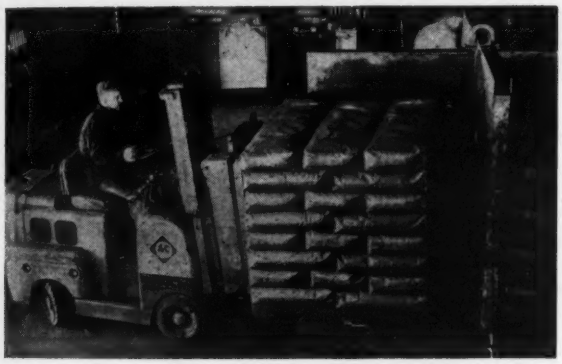
To tie together pallet loads, a stripe of glue is applied to each bag by a glue wheel on the conveyor. From the conveyor, the bags are placed on a rotary palletizing device. This resembles a lazy Susan in operating principle (see photo) and was designed by United Carbon engineers to simplify pallet loading and removal.

Palletized bags are taken by fork truck to a warehouse or directly to a freight car or truck for shipment.

Prevents Blow Back

One of the unique features of the packer is the rubber sleeve which expands to seal the bag valve during filling and thus prevents blow-back of carbon black. The supply

After passing over checkweigher and through roller press, bag is placed on unique palletizing device which can be rotated like a lazy Susan so that loaded pallet may be removed by fork truck



chamber of the packer is also coated with rubber to prevent carbon black from sticking.

Two men are assigned to the packer. One applies the bags alternately to the filling tubes, activates the filling cycle and tucks in the valve sleeve. The second man doubles as a relief operator and utility man, supplying empty bags to the filling station.

Results: The bagging rate has zoomed. The packer handles eight or nine 50-lb bags per minute.

Valve bags cost slightly more, $79.40 per 1000 as compared to $73.10 for open-mouth bags, but this is offset by the faster bagging rate and savings in closing materials, approximately $4 per 1000 bags.

The tightly packed bags are easier to handle and the virtually dust-free operation of the packer both simplifies housekeeping and assures a cleaner-appearing package.

Weight accuracy is 95% ± 4 oz on a 50-lb bag.

(Two-tube Force Flow packer is manufactured by the Bag Division, St. Regis Paper Co., 150 E. 42nd St., N. Y. 17, N.Y.)

Check 1241 opposite last page.

(Carbon black is produced by United Carbon Company, Incorporated, 5650 Kirby Drive, Houston 1, Texas.)

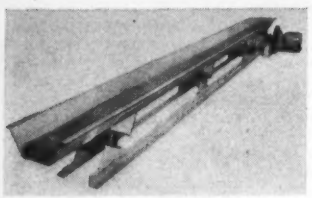
Check 1242 opposite last page.

Unique mounting concept utilizes shear springs on vibrating conveyor

Uses: Conveying variety of materials, ranging from fine dust to hot materials.

Features: Conveyor is mounted on syncro-flex shear springs, eliminating coil and leaf springs. Springs are corrosion-free for "wash down" installations.

Description: Conveyors feature all-metal trough construction of steel, aluminum or stainless steel. Standard



Design of vibrating conveyors is simplified with adaptation of syncro-flex shear spring to materials movement

sizes available in pre-engineered, completely assembled sections, 5 and 10′ long, for conveyor length up to 170′ with one drive. Pans are 6″ deep.

Rubber resonant-frequency springs control trough motion and store inertia at each end of the stroke, resulting in minimum drive forces and uniform distribution of low stresses for trouble-free operation.

(Syncro-flex vibrating conveyors are described in Bul 615 available from General Kinematics, Barrington, Ill.)

Check 1244 opposite last page.

▸ A NEW SOLUTIONS ARTICLE

Steam-traced pipe lines dissolve roadblock in paraffin handling

Problem: Paraffin was received at the Binney and Smith, Inc., crayon plant at Winfield, Kas., in large, solid blocks which had to be melted before being introduced to the manufacturing process.

Among the drawbacks to

this system was the occasional slowdown in production while paraffin was being melted, handling of the blocks and higher costs of the blocks.

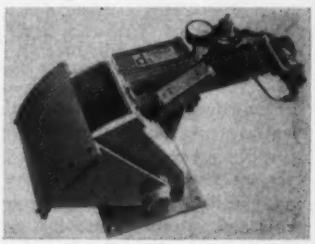
Solution: A network of aluminum pipe lines with built-in passages for steam heat was installed so that the company could handle liquid paraffin instead of block. Liquid paraffin is received in tankcar lots and moved through the pipe to underground storage tanks where it is held for subsequent use.

Results: Under the new system, Binney and Smith, Inc., can purchase paraffin in tank car lots at significant savings. Handling of the paraffin blocks is eliminated.

In addition, there is no slowdown in production while paraffin is being melted. Stearic acid, another ingredient used in crayon manufacture, is piped through the same lines without risk of discoloration.

(Unitrace pipe is manufactured by Aluminum Company of America, 1501 Alcoa Bldg., Pittsburgh 19, Pa.)

Check 1246 opposite last page.



Swing-gate feeder

. . . controls flow of free-flowing materials into automatic weighing systems or continuous process streams. It is available with either two-position full on-off control or with modulated feed control to obtain full-flow to cut-off with modulated response. It can be ordered in a wide range of flow-rates.

(Further information about the swing-gate feeder can be obtained from Dynametrics Corporation, Northwest Industrial Park, Burlington, Massachusetts.)

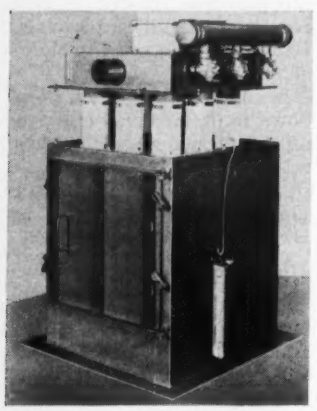
Check 1247 opposite last page.

Compact dust collector mounts on bins

Jets clean filter elements

Uses: Collecting dust from receiver bins of pneumatic conveyor systems; venting bins; aerating bins; and to eliminate return lines from fluidized conveyor truck-unloading points.

Features: Compact unit may be mounted directly on the receiver bin. Electrically chimed jets of high velocity air clean the filter elements,



Bin vent is "scaled-down" version of ultra-high capacity dust collector in use in chemical and other processing industries

eliminating need for internal cleaning mechanisms and cost of replacement parts.

Description: Bin vent may be installed with filter bags projecting directly into bin or with its own filter housing for external mounting on top. Models available with 25, 42 or 63 sq ft of filter area. Operational air-to-cloth ratios are 5 to 15 cfm/sq ft.

(Mikro-Pulsaire bin vent dust collector is manufactured by Pulverizing Machinery Company, Chatham Rd., Summit, New Jersey.)

Check 1248 opposite last page.

For more information on developments reported in this section, check corresponding numbers on Reader Service Slip opposite last page of this issue.

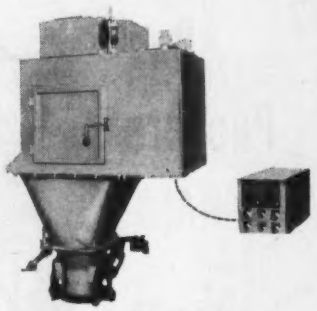
Up to 24 50-lb bags/min weighed accurately by unique scale

Uses: Weighing dry materials for open mouth bags.

Features: Weighs up to 24 50-lb/bags/min of free flowing materials. Accuracy capabilities reaches 2 sigma 1 oz.

Description: Components are friction-free, wear-proof and dust proof.

Key to scale performance is



Even sluggish materials can be weighed rapidly and with consistent accuracy by scale shown with control box at right

ingenious device which speeds up beam response leading to faster speed cutoff.

Controlled dynamic response greatly reduces the effects of variation in the falling column at the end of a weigh, making compensations almost unnecessary. Adjustments, however, can be made to fractional-ounce accuracy.

Beam moves toward balance in perfect dynamic control. Its movement trips a switch to close the inlet gate and/or stop feeder. Then it trips the weigh hopper discharge mechanism, dropping contents through spout into the bag.

A slide, operated by a handwheel with graduated scale, controls material flow by varying the inlet opening.

For gravity feed, an electrically-controlled pneumatic valve opens and closes a sealed, radial gate. An agitator is added in the inlet chute for sluggish materials.

(Speedac E-50 scale is a development of Richardson Scale Company, Clifton, N.J.)

Check 1250 opposite last page.

Instead of being palletized for later removal and manual unloading, reject salt blocks are simply tossed in standby hopper, trucked to refuse pile and dumped

Self-dumping hoppers fill five roles to cut cost, up efficiency

TAKING a second look at odd jobs around the plant can pay some unexpected dividends. A case in point is the experience at the Watkins Glen, N.Y., refinery of International Salt Company.

A NEW SOLUTIONS FEATURE

International produces granulated salt for table use, brine buttons for regenerating water softeners, block salt for agricultural use and specialized products for the chemical, textile and tanning industries.

Barrels and makeshift containers were being used to handle plant trash, reclaim waste salt, collect rejects, etc. This involved multiple handling and, in some cases, manual lifting of heavy loads.

Then someone discovered that five jobs could be performed more economically and more efficiently with self-dumping hoppers. In one case, labor savings amounted to 40%. In all cases, efficiency was improved. International now uses 13 hoppers, ½- and ¾-cu-yd capacities.

Here are the five jobs hoppers handle:

1 Handling of reclaimed products: in the shipping department, hoppers — replacing barrels — are spotted alongside bagging machines. Waste salt, generated during bagging of brine buttons and coarse salt products, is chuted to a hopper. This stream fills a hopper in 45 minutes. Hoppers are carried by fork truck to a crusher where the load is dumped for reprocessing. Since the hoppers hold more than did the container used before, they don't need to be emptied as often; and, finally, they can be dumped more quickly. As a result, six manhours daily are saved.

2 Collecting reject blocks: As 50-lb blocks of salt emerge from the press, the operator inspects them. Previously, broken and ill-formed blocks were palletized,

Check 1252 opposite last page.

Check 1253 opposite last page.

and loaded pallets were taken to the refuse pile where they were manually unloaded. Now, the operator tosses rejects into a nearby hopper. When approximately 30 blocks accumulate in the hopper, the load is fork-trucked to the refuse pile, where a flick of a lever empties the hopper. The empty hopper automatically snaps back into position and locks. This has freed one man for other duties.

3 Inter-floor transportation: Some products, such as brine buttons, must be moved from the first to the third floor. Formerly, these were loaded into barrels. The services of two men were required to lift the loaded barrels onto a four-wheeled platform cart. A third man wheeled the cart to an elevator and then to the third floor. There two more men were needed to upend each barrel into a bin serving the bagging machine.

Now, a fork truck is used to position a self-dumping hopper under the filling spout of a weigh scale. When the hopper has received a predetermined amount, the truck carries it to the third floor, via the elevator. Emptying is simply a matter of raising the hopper and dumping it over the bin.

This innovation released one man at each end of the handling cycle for other work.

4 Refuse handling: Hoppers mounted on casters are used to collect broken bags and general plant refuse. When filled by clean-up crews, the hoppers are carried by lift truck to the dump. About six hopper-loads of trash are dumped daily.

5 Collecting contents of broken bags: A hopper is spotted near the loading station of the shipping conveyor. When a bag breaks, it is emptied into the hopper and the salt reclaimed for re-use. Spillage is thus minimized; housekeeping improved.

(Self-dumping hoppers are manufactured by Roura Iron Works, Inc., 1401 Woodland Ave., Detroit 11, Mich.)

Check 1254 opposite last page.

Check 1255 opposite last page.

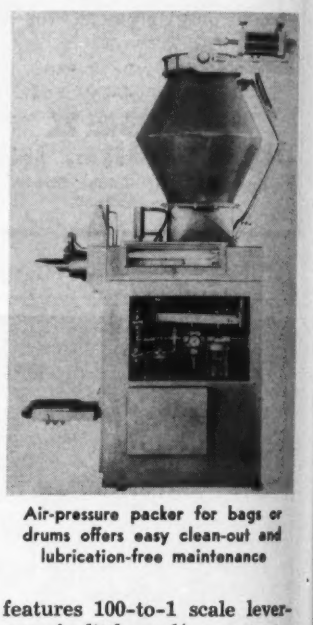
Compact pressure packer combines space savings; electronic accuracy

Checkweighing unnecessary with indicator, trimming

Uses: Packing of powdery, flaky, granulated or pelleted materials in valve and open-mouth bags or drums.

Features: Space-saving pressurized delivery system reduces headroom to maximum of 10′ 8″. Optional pressure chamber allows installations with head room of 87½″. Floor width is 38″.

Description: True-scale beam



Air-pressure packer for bags or drums offers easy clean-out and lubrication-free maintenance

features 100-to-1 scale leverage. As little as ¼ oz actuates electronic sensing capacitor which functions without direct connection or sparking. Over-under weight indicator and easy electronic trimming makes checkweighing unnecessary.

All pressure gages, valves and electrical controls are readily visible to and within reach of operator. Electrical controls are in a dust-tight enclosure. Packer is designed for 20 to 250 lb packed weight.

(Further details on Stok-Aire pressure packers may be obtained from H. L. Stoker Company, PO Box 112, Claremont, Calif.)

Check 1257 opposite last page.

NEW LITERATURE

Material Handling and Packaging

Problems and questions pertaining to bulk packaging and unloading of polyethylene resin are answered in 24-page booklet. Some points touched are: 1) whether to buy in bulk; 2) which type of bulk packaging to use; and 3) which type of unloading system to choose. Bulk Handling Bul — U.S. Industrial Chemicals Co., Division of National Distillers and Chemical Corporation.

Check 1258 opposite last page.

Flexibility and portability are combined in power conveyor suitable for carrying material around corners, up into trucks, boxcars or other problem areas. Telescoping legs permit adjusting for various heights. Material is conveyed by interlocking flights attached to calibrated chain. Flexo Power Bul — California Conveyor Corporation.

Check 1259 opposite last page.

Chemical feeder, specially designed to handle powders having variable densities and flow characteristics, is subject of 50-A3 Feeder Bul — Sterwin Chemicals, Inc., subsidiary of Sterling Drug Inc.

Check 1260 opposite last page.

Processing of cast polypropylene film is described in 12-page technical booklet, which covers markets, properties, processing, converting and packaging. Profax Film Bul — Hercules Powder Company.

Check 1261 opposite last page.

Changes in designations for 40 of manufacturer's cellophane types are explained in bulletin. Square-inch yield identification replaces conventional 300-, 450-, and 600-gage designations. Cellophane Specifying Bul — Film Department, E.I. du Pont de Nemours & Company.

Check 1262 opposite last page.

Vibrating feeder, which features a solid drive connecting rod controlling amplitude of stroke and insuring constant flow of material with any setting regardless of varying headload, is described in Bul 261 — Stephens-Adamson Mfg. Co.

Check 1263 opposite last page.

Travelling cranes, which are electric powered for overhead service, are cataloged and some applications cited in 20-page Bul 15005-1B — Crane & Hoist Division, Manning, Maxwell & Moore, Inc.

Check 1264 opposite last page.

Check 1265 opposite last page.

'MONOMER CASTING'

Promises expanded use of nylon in chemical processing equipment

Technique permits low-cost production of massive, complex nylon shapes and contours with a saving in raw material costs approaching 50%

Uses: The possibility of making large nylon shapes in a manner similar to that used in the conventional foundry makes "monomer cast" MC® nylon a possible substitute for various cast metals. In addition, reduced raw-material and fabricating costs place nylon in a competitive position with other polymers (ABS, epoxy) in the medium- and low-priced areas (see Chart I).

For nylon produced by melt-pressure techniques, the majority of uses have been for parts requiring outstanding wear and abrasion resistance, chiefly in the absence of effective lubrication. With reduction in costs offered by monomer casting, these characteristics can be extended to a wider variety of products.

MC nylon could be considered wherever castings of stainless steel, brass or bronze are now used (see Chart II), provided the end use does not require: temperature resistance — it is limited to 250-300°F on prolonged exposure; resistance to strong acid — MC nylon fails quickly; tensile strength — metals are two to 10 times stronger.

It will offer resistance to alkali and mild acids. Properties of resilience, sound damping and ability to absorb shock and vibration are important plus factors.

Features: The process permits direct conversion of monomeric raw material into finished nylon products at atmospheric pressure.

Raw material costs halved — By eliminating the five steps used in the conventional method of manufacturing molding powder, the process starts with approximately one-half the raw-material costs of conventional techniques.

Sizes, thicknesses unlimited — MC nylon is "cast" from monomer without pressure. It polymerizes to a solid uniformly throughout the mass without forming vacuum bubbles. Parts of unlimited thickness can be cast in an almost unlimited variety of sizes and contours. Fine detail such as limited undercuts and reverse steps can be accurately reproduced.

Total costs slashed — Lower material costs, unlimited cross-sections, and lower tooling costs (about 1/10th or less for a seven-pound piece compared to injection molding) mean that large contour shapes can now be made economically.

The phyiscal properties are reported to be equal to other nylons and in some areas even better. Properties may be economically tailored to end-use requirements.

Description: The basic chemistry involved in monomer

CHART I

Raw Material Price Comparisons

Material	Dollars/lb	Cents/cu in
Polycarbonates	1.25	5.43
Nylon polymer	0.98	4.06
Acetal resin	0.60	3.12
Epoxies	0.60	2.61
ABS polymer	0.60	2.26
MC nylon	0.46	1.93
Polypropylene	0.40	1.32
Linear polyethylene	0.35	1.19

A 4½-foot-diameter gear, *cast directly from monomeric raw material, is discussed by Louis L. Scott (left), president, and Ralph E. James, vice president, The Polymer Corporation*

***Variety** of parts demonstrates versatility of monomer casting process which can economically produce large and complex custom-cast nylon shapes*

casting was discovered by Monsanto Chemical Company. The Polymer Corporation has acquired the exclusive right to use the process in the field of casting nylon shapes in the U. S. and in many other countries. Production procedures have been developed from laboratory to commercial scale.

Caprolactum monomer is heated just above the melting point (150°F) under an inert gas blanket. As mobile liquid monomer is pumped to the mold, a catalyst is added and the two thoroughly mixed. Careful chemical controls are required and temperature is critical. Production must be timed and controlled to an exacting degree.

Direct production of parts from monomer also permits incorporation of a high concentration of fillers: up to 75% by volume. This increases dimensional stability, compressive strength, wear and frictional properties. Inexpensive fillers can further reduce ma-

To next page

CHART II

CUSTOM CASTING COSTS

(188-cu-in part size)

Material	Weight/lb	Dollars/lb	Unit price	Cents/cu in
Stainless steel (304)	46	1.18	$54.28	34.4
Extrusion-molded nylon	6.6	6.70	43.70	27.7
Bronze	51	.68	34.65	21.9
Yellow brass	48	.64	30.60	19.4
MC nylon (present)	4.6	3.32	21.91	13.9
Mild carbon steel	46	.32	14.72	9.3
MC nylon (future)	6.6	2.00	13.20	8.4
Aluminum 40-E	14.5	.87	12.60	8.0
Aluminum A-108	14.5	.76	11.00	7.0
Cast iron	42	.195	8.19	5.2

Prices based on actual present quotations on 1000-piece lots of rough casting +1/32", —.00. Pattern costs and subsequent machining costs are not included. For many uses, nylon does not require the expensive finishing necessary with metals.

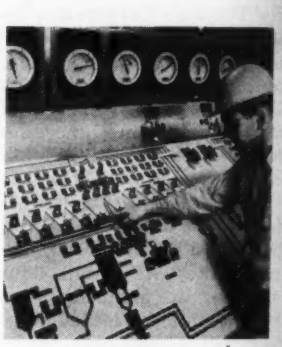
terials costs.

Depending on part geometry, contour-cast parts ranging from one to 100 lb can be produced on a limited scale. The largest parts produced to date have been semi-finished symmetrical shapes in the 500- to 700-lb range. A steel casting of the same size would weigh over two tons. Tolerance capabilities are similar to those of sand-cast steel. It is anticipated that these tolerances will be improved with experience.

MC nylon is commercially available in stock shapes such as tubular bar from two to 15" in diameter in lengths up to four feet. Plate up to four inches thick, in four-foot by four-foot sections, can also be obtained. Castings now cost between $3 and $5 per pound.

(MC nylon is a product of The Polymer Corp., Reading, Pa.)

Check 1268 opposite last page.



Smoke from 10 furnaces

. . . is controlled automatically from this visualized control console at U.S. Steel Corporation's Geneva plant in Utah. Extremely small dust and fume particles are removed from the stack gases of the open hearth furnace by electrostatic precipators. The system makes automatic high-speed adjustments in electric power to precipitators as the concentration of gas particles changes in flue gases from each of the ten furnaces.

(Smoke control system, including precipitators, is engineered and manufactured by Research-Cottrell, Inc., Bound Brook, N.J.)

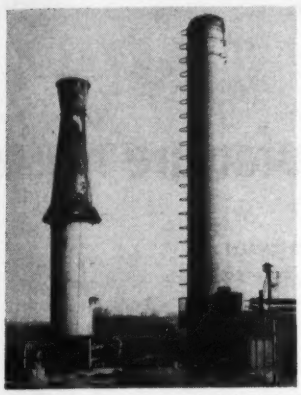
Check 1269 opposite last page.

▸ A NEW SOLUTIONS ARTICLE

Cyanide waste incinerated without traces in exhaust by special unit

Industrial cyanide waste material, a perennial problem child of pollution control authorities, is being handled routinely at General Motor's Oldsmobile Division in Lansing, Mich.

Oldsmobile disposes of the cyanide waste in a specially designed incinerator. Combustion efficiency of the incinerator is such that no detectable amounts of cyanide are exhausted.



Cyanide incinerator (left) has 50' high stack; masonry structure at right is used for rubbish disposal

System consists basically of a giant refractory-lined steel stack, a burner unit and suitable storage tanks, hoppers, mixing vats, pumps, valves and controls.

Slurry is formed

Cyanide is dumped into the hopper from above, transferred to a pre-mixed tank, supported on springs, by screw conveyor. When proper weight of cyanide waste has entered tank, springs deflect, causing a dog to trip the limit switch and shut off the conveyor.

Water is added and thoroughly mixed with waste to form a slurry which is then pumped to the blending tank. There a measured amount of waste-soluble oil is added, and blended with the slurry to proper consistency for incineration. This then is pumped to holding tank from where it is eventually pumped under controlled pressure to burner.

(Cyanide waste incinerator is a development of Prenco Manufacturing Corp., 2605 W. Fourteen Mile, Royal Oak, Mich.)

Check 1270 opposite last page.

Boiler water requirement reduced as much as 50% with processing system

Designed for use on boilers from 100 to 2000 hp

Uses: Processing water for steam generation, cooling and heating, or process-water boilers from 100 to 2000 hp.

Features: Reduces water requirements up to 50%; cuts cost of chemicals about 80%; and reduces fuel requirements about 8%. Boiler life can be increased as much as 2½ times.

Description: Single boiler system consists of a pressure vessel for filtering, chemical feed and automatic controller, a blowdown analyzer, a recycle pump and tank, and an automatic slurry feed. Operation is continuous and automatic.

Three actions occur in the filter system: Filtering, flocculation and deaeration. The filter consists of a specially woven asbestos fiber, finely divided carbon and other ingredients for absorbing silica and other hardness-contributing material.

Residual level of chemicals and concentration of dissolved solids is maintained to a level under 3450 ppm by the automatic operation of the blowdown analyzer. Every operational hour it analyzes a half-gallon of water and makes any needed adjustments.

Unit is installed adjacent to the boiler. The models vary in size from 6 x 3 x 5′ to 12 x 4 x 9′.

(Filtrion system is a development of Ster-O-Matic, Inc., Mundelein, Ill.)

Check 1271 opposite last page.

If you're reading this by artificial light, we'll wager that the light is emanating from the very materials whose manufacture is described, possibly for the first time, in this article. Few companies manufacture these materials, but those who do have been very secretive about their processes for fear that a competitor may gain some valuable information. While the odds are also great that you are not specifically concerned with, or more than academically interested in, phosphor manufacture, techniques used, particularly control of particle size, should yield some valuable ideas

Phosphor manufacture means

By G. P. MORTENSEN
Westinghouse Electric Corporation

MANUFACTURING PHOSPHORS, particularly "halophosphates," is a complicated process requiring management of many variables and increasing attention to detail.

Halophosphates (used in fluorescent lamps) consist of solid solutions usually containing more than one alkaline-earth metal and halogen and also non-stoichiometric quantities of various ions. A general formula for a calcium halophosphate would be:

$3M_3(PO_4)_2 \bullet 1M'L$: activators

M and M' are alkaline earths such as calcium and strontium; L represents the halogens Cl_2 and F_2, and the activators are such elements as antimony and manganese.

Mr. Mortensen is engineering section manager, phosphor section, lamp parts engineering, of the Westinghouse Lamp Division, Bloomfield, New Jersey.

Each tray is inspected under an ultra-violet light after it has cooled to determine visually whether mixing is adequate and the formulation correct

Unfired material is loaded in fused silica trays onto the furnace conveyor

managing many variables

The composition of a specific phosphor depends upon the color desired. Formulae vary from no manganese for blue lamps to the highest percentage for yellow. Also, the ratio of CaO to P_2O_5 varies, depending upon the color sought.

Tremendous strides have been made in lumen output (the measure of the flux of light from a lamp) and luminous efficiency (the lumen output per watt of electricity). For example, a 40w-incandescent bulb produces 468 lumens at an efficiency of 11.7 lumens/w. In contrast, a 40w-warm-white fluorescent bulb (comparable in color) produces 2900 lumens with an efficiency of 72.5 lumens/w.

Although some of the gains can be attributed to lamp design, improved materials and manufacturing techniques, the bulk have been, and probably will be, due to improvements in manufacturing techniques, chemical quality and physical characteristics of raw materials.

Phosphor Starting Materials Must Be Pure, Uniform

In the manufacture of calcium halophosphate phosphors, the starting materials must be ultra pure and uniform from lot to lot, a condition which is fairly typical of all phosphor manufacture. Since a C.P. grade chemical is not nearly pure enough, a special grade, S.L. (Standard Luminescent), has been created. These are ultra-pure chemicals, having less than 0.01% trace constituents. In addition, physical characteristics are becoming increasingly important.

Calcium phosphate, dibasic, calcium carbonate — these represent about 80% of the formulation — strontium chloride, antimony trioxide, manganese carbonate and calcium fluoride are so thoroughly blended that when fired below the fusion temperature a homogenous cake is achieved. Mixing is either dry or by wet ball milling and then drying. When the fired cake is viewed under ultra-violet light, the color must be completely homogenous — no off-color spots. Activators must be intimately mixed with the calcium phosphate by a mulling or grinding action.

A double-tunnel continuous kiln or furnace is used for the firing operation. This is complicated by several variables — tray fit, air flow, firing temperature and feed rate — which must be closely controlled to produce a quality phosphor.

The mix is loaded into a

To next page

fused silica tray and covered with another silica tray. Since a perfect seal can not be maintained, an effort is made to maintain a seal which will limit the loss of such volatile constituents as antimony, chloride and fluoride to predictable levels. The original formulation of the mix is adjusted to allow for this loss. If the actual loss is too high, the fired material will not fluoresce. If the loss is too slight, the phosphor is brick hard and the lumen output is low.

Air is drawn through the furnace counter-current to the flow of material under controlled conditions. This 1) maintains the heat balance, minimizing the heat shock and, consequently, breakage; 2) conserves heat by cooling outgoing trays and heating incoming trays; 3) assures a uniform tray and furnace atmosphere, thereby regulating volatile leakage.

Some antimony sublimes as the chloride on the side walls and roof in the preheat zone of the furnace. This buildup constricts the flow of air, which must be, as a result, periodically adjusted to compensate for this condition.

Firing temperature, ranging from 1150° to 1190°C to approach as nearly as possible the fusion temperature of halophosphates without fusing the material, is especially critical since minor variations profoundly affect cake hardness and lumen output.

For optimum results, variables must be constantly juggled as changes occur.

Following the first firing, each tray is inspected. Extraneous material like spalled silica from the trays and off-color material caused by tray leakage are removed. The cake is then crushed and hammer-milled, fired a second time, inspected, crushed and hammer-milled again.

Particle-size Control Vital In Phosphor Manufacture

Cost and quality considerations make particle-size control vital. Particles range between 5½ and 15 microns for

To page 122

Grashof Number

GEORGE M. MACHWART
Michigan College of Mining and Technology
Houghton, Mich.

The magnitude of heat-transfer effects is measured by dimensionless groups. These are also used as a criterion of dimensional analysis, especially in connection with model and scale-up studies. The dimenisonless group used in natural convection is the Grashof Number:

$$N_{Gr} = \frac{D^3 d^2 \beta g \Delta t}{\mu^2}$$

where:
- D = pipe diameter, ft
- d = density, lb/cu ft
- g = acceleration of gravity, ft/hr/hr
- β = volumetric coefficient of expansion, (cu-ft/cu-ft)/°F
- Δt = temperature difference between fluid and wall, °F
- μ = Viscosity, lb/(ft)(hr)

Typical Example

To use the nomograph, draw a straight line from 100 on the d-scale to 1000 on the β-scale to intersect R_1. From the intersection on R_1, draw a line to 10 on the Δt-scale to cross R_2. From this intersection, draw a line to 0.1 on the D-scale to intersect R_3. Finally, from this R_3 intersection, draw a line to 100 on the μ-scale to cross the N-scale at 4.3×10^9. Use of the formula results in a value of 4.2×10^9.

nomograph on page 123

Phosphor manufacture

From page 120

80% of the material. Of the remainder, 7.7% are under 5½ microns, 11% over 15 microns.

If particle size is too large, the particles may not adhere fully to the bulb walls, leaving clear areas. In such event, the phosphor cost per lamp would be prohibitively high. On the other hand, if the particle size is made too small, lower lumen output is inevitable.

This means that either the process must be adjusted to produce the desired particle size range or the coarse and fine fractions must be separated out and only the remainder used.

Westinghouse has resorted to particle-size separation, using an air separator for the purpose. The powder is put through the machine, at a predetermined setting, to remove coarse particles. The setting is then changed and the powder, minus the coarse particles, is reprocessed to remove the fine particles.

Phosphors are tested after every major processing step and the finished phosphor is tested in lamps. ■

Isotope course offered by AEC for engineers

Special radioisotope techniques courses for engineers interested in applying radioisotopes to engineering research, development and continuous process measurement and control are being offered by the Oak Ridge Institute of Nuclear Studies for the AEC.

Participants may choose either four or six weeks of instruction. Longer sequence includes advanced techniques.

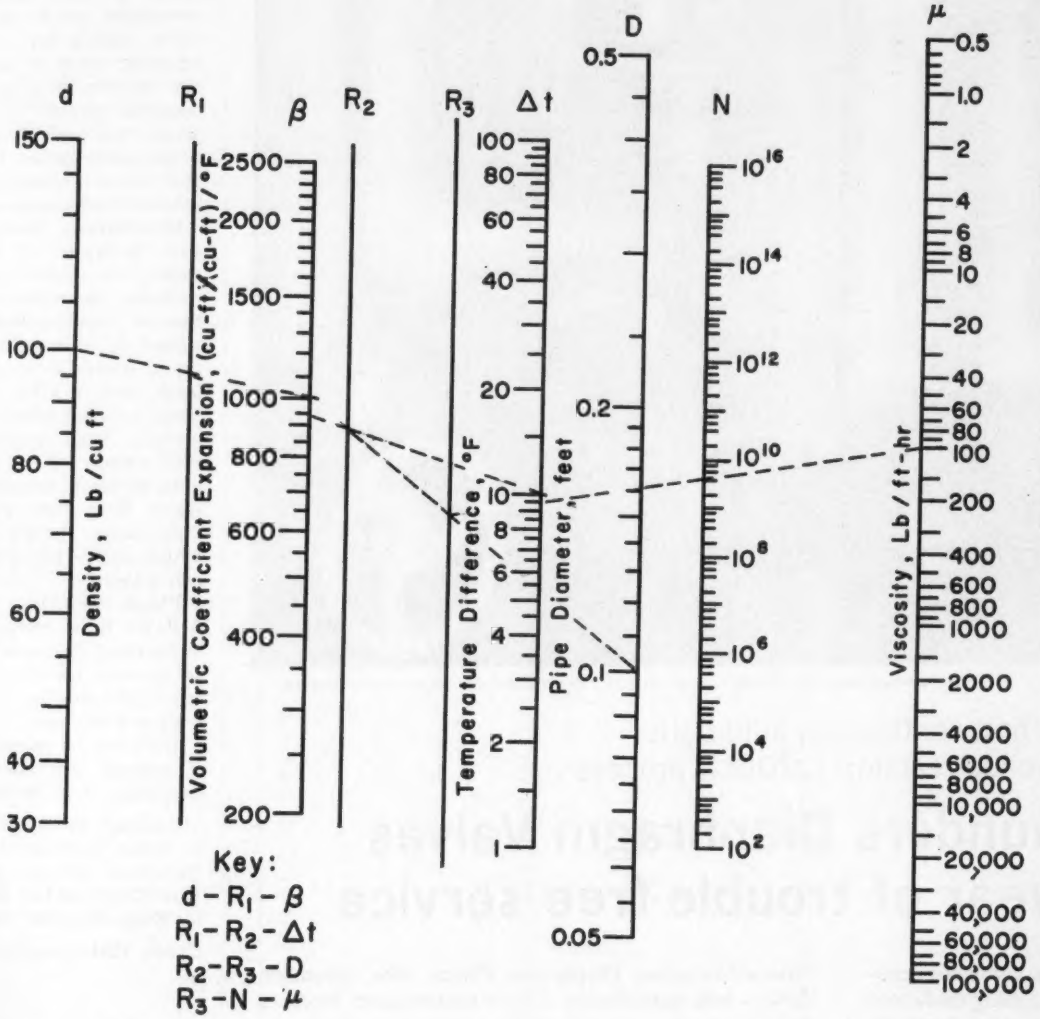
Tentative starting dates for courses in 1962 are: January 8, March 5, April 30 and August 6.

(Further information may be obtained from Dr. Ralph T. Overman, Special Training Division, Oak Ridge Institute of Nuclear Studies, PO Box 117, Oak Ridge, Tenn.)

311

Grashof Number

From page 121



IDEAS

Modules of plastic packing form aerating tower of desired size

Uses: Plastic packing for treatment of waterborne wastes in trickling filter applications.

Features: Unique self-facing design permits sheets to be assembled side by side to form cubic module for erecting an aerating tower of appropriate size. Sheets, molded of saran material, resist all common acids and alkalies, except strong ammonium hydroxide, and most alcohols, esters, ketones and nitroparaffins.

Description: Material consists basically of individual sheets, corrugated in two directions, measuring 36 x 21". Special configuration is designed 1) to distribute falling liquid wastes in thin films over large surface areas for maximum aeration efficiency; 2) to provide high percentage of void space for unimpeded natural-draft ventilation and waste flows; and 3) to provide large surface areas to which active biological slimes can adhere.

Plastic packing, weighing 6 lb/cu ft, is completely self supporting. A simple enclosure to protect the packing from wind and weather is the only wall requirement.

Unit can be assembled with a special automatic welder available from manufacturer.

(Dowpac® 20A plastic packing is being introduced by Dow Industrial Service, division of Dow Chemical Co., 20575 Center Ridge Rd., Cleveland 16, O.)

Check 1281 opposite last page.

Air pollution analyzers, designed to monitor and record low concentrations of oxidants, oxides of nitrogen or sulfur dioxide in the atmosphere, are subject of Bul K-4023 — Scientific and Process Instruments Division, Beckman Instruments, Inc.

Check 1282 opposite last page.

Latest developments in production and distribution of sulfur are updated in revised edition of Modern Sulphur Mining — Texas Gulf Sulphur Co., Sales Dept.

Check 1283 opposite last page.

Tons of Pulp per Hour vs GPM

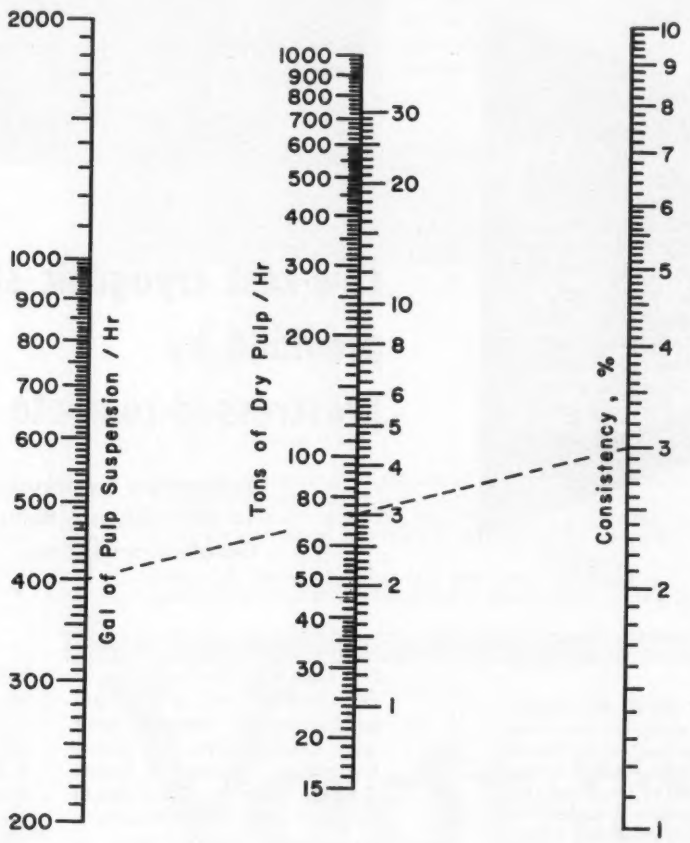
S. E. HENRY
Crossett, Ark.

This nomograph is useful in computing pulp-production rate from flow rate of pulp-water mixture and the consistency. It may also be used for slurries, if it may be assumed that the density of the mixture is the same as water.

The nomograph is based on the following equations:

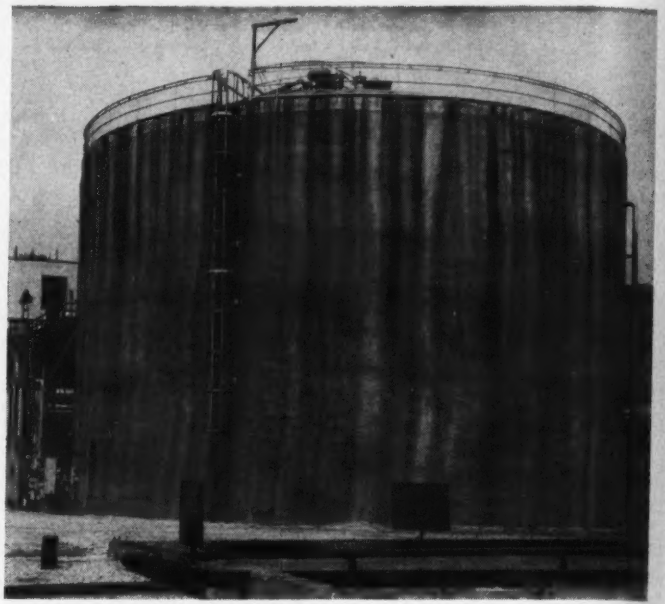
Tons/hr = (gal/min) (% consistency) (2.25 x 10^{-3})

Ton/day = (gal/min) (% consistency) (6 x 10^{-2})



INDUSTRIAL CRYOGENICS

Liquid oxygen at —297°F has been successfully stored in this dual-shell, prestressed-concrete tank since 1953



Low-cost cryogenic storage provided by prestressed-concrete tanks

Satisfactory performance in liquid-oxygen service suggests tanks may be useful for liquefied natural gas

NO EVIDENCE of spalling or deterioration has been found in prestressed concrete tank used successfully by Linde Company, division of Union Carbide Corp., to store liquid oxygen since 1953. Structure has been in service since its construction except for a brief out-of-service period in 1958.

With prestressed concrete, size of individual tanks is not limited by structural problems encountered in metals. Maximum storage economy can be achieved. For example, cost per barrel stored in a 300,000-bbl tank is only 60% of cost per barrel in a 50,000-bbl tank.

Tank at Linde stores 75 million cubic feet of oxygen as a liquid at — 297°F. It is constructed on dual-shell principle. A thick layer of foamglass insulation confined by a prestressed-concrete stub wall comprise the foundation. Liquid-containing tank consists of a concrete wall, prestressed circumferentially and vertically; a concrete dome roof; and a concrete floor over which is placed a stainless-steel pan connected to bottom of wall.

Exterior tank is also of

prestressed concrete and is designed to take same loads as interior wall so that it acts as a safety wall in addition to confining the bulk insulation in the annular space between the two tank walls. An outer concrete dome covers exterior tank and provides an annular space for bulk insulation over roof of inner tank.

Tests by Linde, from which designs were made, found that compressive strength and modulus of elasticity of concrete increased substantially when subjected to liquid oxygen temperatures. In addition, relatively high carbon steel wire, used for prestressed reinforcement, is not adversely embrittled when tank is used to store low-temperature liquefied gas.

At present, a program is under way directed to liquid methane storage in buried prestressed-concrete tanks. Tank manufacturers is executing a contract with American Gas Association for design of 1000- and 300,000-bbl tanks.

(Prestressed-concrete tanks are designed and constructed by The Preload Company, Incorporated, 355 Lexington Avenue, New York 17, New York.)

Check 1286 opposite last page.

Cryogenic data card gives 11 physical properties of 31 low-temperature fluids, with boiling points ranging from −44 to −450°F. Data are given in both English and metric units. Other side of card gives thermal characteristics of seven cryogenic insulations, a table of conversion factors, along with special properties of hydrogen and some other cryogenic fluids. Cryogenic Data Card — Cryogenic Engineering Company.

Check 1287 opposite last page.

Nitrogen, both in liquid and gaseous form, is subject of 16-page bulletin. Engineering data and conversion factors presented in detail should prove useful. Form 5896 — Liquid Carbonic Division of General Dynamics.

Check 1288 opposite last page.

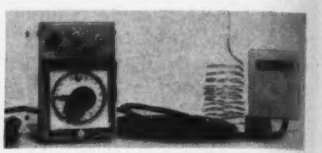
Liquid nitrogen and how it can be used to advantage for preserving biological materials is discussed in eight-page Bul F-1270— Linde Company, Division of Union Carbide Corporation.

Check 1289 opposite last page.

Check 1290 opposite last page.

Liquid nitrogen losses cut by automatic control device

Design of automatic device makes it possible to eliminate manual filling of liquid nitrogen traps, and containers, saving labor costs, cutting product losses and providing fullest utilization of equipment. Vapor-charged remote sensing bulb actuates a switch which, in turn, energizes a solenoid during filling cycles. Plug-in timer regulates high liquid level and provides instant interchangeability. Unit has features which insure safe operation.



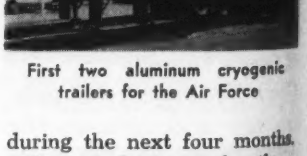
Control maintains nitrogen within ½°F

(For further information on Model NCT-5 liquid nitrogen control contact Almac Cryogenic Air Company, 1108 26th St., Oakland 7, Calif.)

Check 1292 opposite last page.

Aluminum construction gives oxygen trailers 40% more capacity

First two aluminum liquid oxygen transport trailers for the U.S. Air Force were recently delivered. About 45 such tankers will be delivered during the next four months.



First two aluminum cryogenic trailers for the Air Force

Use of aluminum for these trailers will make each one 11,000 lb lighter. Hence, each one will have 40% greater capacity due to the load limit imposed on such trailers by

various states. Each trailer will hold 4000 gal of liquid oxygen at -297°F. All such trailers used by the Air Force in the past were fabricated from various specialty steels.

Trailers are used for hauling liquid oxygen for major missiles, such as the Atlas and the Titan, to provide a flexible supply system in the event of rapid missile site relocation.

(Aluminum trailers are being built by Air Products, Inc., Allentown, Pa.)

Check 1293 opposite last page.

Miniature solenoid suited for use at −420°F

Uses: Solenoid can be used with the gaseous and liquid forms of oxygen, nitrogen, hydrogen and other cryogenic fluids. It can also be used with

Solenoid will deliver 10¾ lb force

hydrogen peroxide, hydrazine, ethylene oxide, nitrogen tetraoxide, dry methyl chloride and fuming nitric acid.

Features: Unit is suitable for applications as low as −420°F and is corrosion resistant.

Description: Solenoid is only 1" in diameter by 1-¾" long and weighs only 4½ ounces. Unit is made of 17-4H and 304 stainless steel. It is available in various ratings for particular requirements.

(Solenoid is product of Electroid Corporation, 95 Progress St., Union, N.J.)

Check 1294 opposite last page.

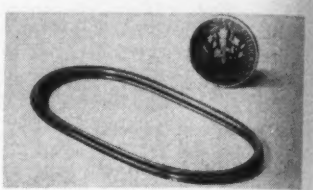
Turbine flowmeters for cryogenic fluids and other liquids and gases are described in 12-page Bul 1384C — Cox Instruments Division, George L. Nankervis Co.

Check 1295 opposite last page.

CRYOGENICS

From −320 to 1500°F temperatures handled by spring seal

Contoured static spring seal, used with a retaining flange, is suitable for use with liquid and gas conduction systems where extreme pressures and temperatures are encountered. Use of silver-plated Inconel-X



Size of static spring seal compared to a dime

construction permits units to handle temperatures from −320 to 1500°F.

Spring action of seal is achieved from its bellows configuration created by finely machined grooves in heat-treated metal ring. Seal immediately resumes its original free length after it is released from compression, even under extreme conditions.

(Static spring seal is product of Hydrodyne Corporation, 7350 Coldwater Canyon Ave., North Hollywood, Calif.)

Check 1300 opposite last page.

Cryogenic valve offers low leakage

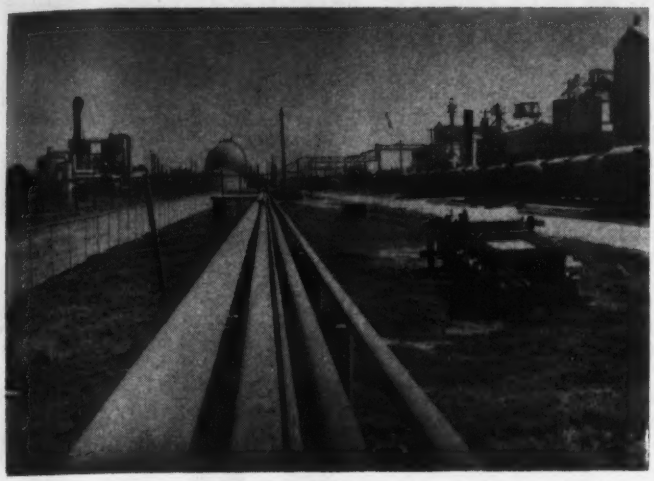
Uses: For handling liquid hydrogen, liquid oxygen and other cryogenic materials.

Features: Unit leaks less than 10 cc/min of helium at cryogenic temperatures.

Description: Butterfly valve is equipped with a double-acting pneumatic activator. Four-way valving is solenoid operated. Unit has overriding spring closure in event of loss of actuating supply pressure. Valve is available in various sizes.

(Butterfly valve is product of B. H. Hadley, Incorporated, 1427 S. Garey Avenue, Pomona, California.)

Check 1301 opposite last page.



Sulfur line (left) runs from dock where barges are unloaded to storage facilities

Steam-traced system using heat — transfer cement —

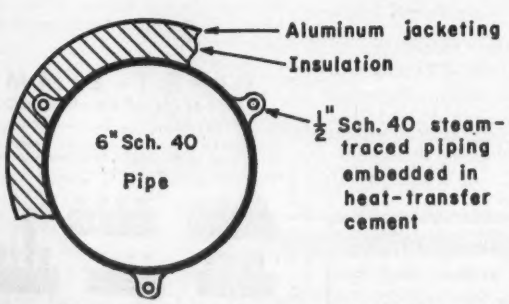
Prevents freeze-ups of 1300′ sulfur line

By **GORDON WEYERMULLER,** Associate Editor
with **FRANK W. BLESS JR.,** Works Manager
Coastal Chemical Corporation, Pascagoula, Mississippi

MORE than 175,000 long tons of sulfur have been transferred through a 1300′ line that has steam tracing covered with a heat-transfer cement known as Thermon. Not a single freeze-up has occurred since the line was placed in operation at Coastal Chemical Corporation in January 1958. No repairs or replacements of the heat-transfer cement or the steam tracing have been necessary since the startup.

The 1300′-long, 6″-diameter line is used to move sulfur from barges to storage facili-

To next page



Cross-sectional view of steam-traced sulfur line

ties for use in the company's sulfuric acid plant. Normally, about 2500 long tons of sulfur are unloaded through the line twice a month during a period of six to eight hours. The transfer line is not drained but is allowed to set full of sulfur.

If such a line were not heated in some way, the sulfur could not be maintained in the liquid form during unloading. Steam jacketing was considered. However, steam tracing and heat-transfer cement were chosen because this method was found to be less costly than steam jacketing or some other procedure.

The Thermon heat-transfer cement is an inorganic material, supplied in paste form, that has excellent heat-transfer characteristics. Use of cement spreads heat over the surface of the pipe so that the steam is utilized efficiently.

Three ½" steam tracers are embedded in the heat-transfer cement for the entire length of the 6"-diameter sulfur line.

Over this a 1½" thickness of Kaylo-20 insulation was placed to avoid loss of heat to outside. This insulation is composed of calcium silicate and a small amount of asbestos fiber. The insulation, which is water resistant and suitable for temperatures up to 1800°F, is protected with aluminum jacketing on the outside.

The transfer system includes three 6" gate valves, one check valve and one ball valve. These valves are also heated by steam tracing embedded in the heat-transfer cement.

(Thermon heat-transfer cement is product of Thermon Manufacturing Company, 1017 Rosine St., Houston, Texas.)

Check 1304 opposite last page.

(Kaylo-20 pipe insulation is product of Owens-Corning Fiberglas Corporation, National Bank Bldg., Toledo 1, Ohio.)

Check 1305 opposite last page.

For more information on developments in this section, check the Reader Service Slip.

THAT'S INTERESTING

Magnesium in blood

Investigation of the role magnesium plays in the blood, using an atomic research reactor, may lead to new ways of storing blood so that it will be usable over longer span.

In the study, a sample of blood is exposed in a reactor for a prescribed time. Then its emitted radiations are analyzed electronically according to their energies and charted.

From this is determined the amounts of magnesium, copper, zinc and manganese present.

One thing researchers hope to determine is whether magnesium content of blood varies.

Tire diet deficient

A controlled deficiency in a chemical diet may hurry up the arrival on the market of hardy, better-riding polyester cord tires.

The diet deficiency helps impart the necessary adhesive qualities to make the cord an integral part of a finished tire.

On-the-spot water supply at precise temperature, heating or cooling

Uses: Supplying up to one kw of heat or cooling to maintain optimum operating temperature of critical equipment. This could include computer systems, reactors, etc.

Features: Unit will hold temperature of water supplied to ± 1°F. Both flow rate and temperature of water delivered to operating equipment are

Portable water supply maintains optimum operating temperature

adjustable over a wide range. Easy, flexible and fail-safe operation is afforded through control and audio-visual alarm systems.

Description: Portable water supply is a closed system with a stainless steel tank holding two gallons and a pump capable of delivering up to 2.7 gpm at 55 psi.

(Powertherm Model E-1147-1 portable water supply is a product of Astro Dynamics, Inc., Second Avenue, Northwest Industrial Park, Burlington, Mass.)

Check 1309 opposite last page.

Two basic pump types spawn 72 combinations

Uses: Process-pumping applications.

Features: From two basic pump types, as many as 72 combinations are possible. By interchanging impellers, covers, nozzle arrangements, bearing construction, cooling

methods and other components, requirements for almost any given service can be met from standard, off-the-shelf parts.

Description: Pumps incorporate air-cooled bearing housings. Each uses a built-in fan-cooling system which eliminates need for cooling-water supply to bearings in many applications.

One basic model (SMJ) is designed for high-temperature service with either top or end suction. It is vertically split with center-line-support mounting and has water-jacketed stuffing-box for either packing or mechanical seal. Single- or double-stage construction is offered, as well as single or double suction. Capacities are available to 1200 gpm, differential heads to 1600′, for pressures to 1000 psi and temperatures to 850°F.

Second type (SMJI) is internally sealed version of first. It uses mechanical seal as standard construction. This type is for use with temperatures to 400°F; all other capacities are the same as with the SMJ models.

(Eight-page bulletin describing SMJ and SMJI pumps is available from Byron Jackson Pumps, Inc., Subsidiary of Borg-Warner Corporation, Box 2017 Terminal Annex, Los Angeles 54, Calif.)

Check 1310 opposite last page.

One-coat roof protection provided by liquid

Uses: Protective treatment for roofs.

Features: Treatment is self-reinforcing with built-in mat. Doesn't seam, crease or check.

Description: Liquid roof treatment is blend of high-solids-content asphalt emulsion, glass fibers and rough, curly bristles. When applied, asphalt and fibers interlock forming monolithic protective blanket.

(Liqui-Mat roof treatment is being introduced by The Tremco Manufacturing Company, 10701 Shaker Blvd., Cleveland 4, Ohio.)

Check 1311 opposite last page.

Check 1312 opposite last page.

Chemical Boobytraps

Unsuspected hazards awaiting the unwary

Cylinder explosion caused by regulator friction

A worker was recently injured when a pressure-reducing regulator exploded shortly after it was connected to a full cylinder of oxygen.

It is believed two conditions might have caused the fire and resulting explosion: 1) a small amount of grease or oil was on the fitting of the cylinder, or 2) the seat of the regulator valve was heated to ignition temperature by the friction caused by the oxygen passing through the partially opened valve.

Inasmuch as there was no evidence of oil on the cylinder fitting, it is believed that the latter condition was the cause of the explosion.

Although most people are aware that the regulator valve should be closed before the cylinder valve is opened, in some cases it is common practice to leave the regulator set at the normal working pressure.

The instruction manual for cutting and welding equipment clearly states that the regulator valve should be closed before the cylinder valve is opened. This avoids heat of compression through the rapid build-up of pressure in the regulator.

Furthermore, the cylinder valve should be opened slowly and then the working pressure adjusted by the regulator valve.

(Contributed by Howard H. Fawcett, Safety Director, Research Laboratory, General Electric Company, Box 1088, Schenectady, N.Y.)

For more information on developments in this section, check the Reader Service Slip.

Driver test by computer

Applicants for driver's licenses may find the traditional examiner backed up by a computer in the future, if Dr. D. S. Himmelman of RCA is any kind of a prophet.

Dr. Himmelman suggests that a computer could be used to weed out accident-prone individuals who apply for licenses.

A would-be motorist would be tested behind the wheel of an automobile mock-up with a motion picture of varying road conditions rereplacing the customary windshield.

Electroencephalographic signals emanating from his or her brain would be transmitted to the computer for comparison with previously-determined standards of acceptable reaction.

For more information on product at right, specify 1315 see information request blank opposite last page.

ENGINEERING & SAFETY

Ready-to-assemble dome offers low-cost shelter

Uses: Supplemental or job-site warehousing, storage of tools, vehicles and supplies, construction "shack" and field crude housing.

Features: Structure, 22′ in diam, is sturdier, more durable and costs less than equal-size tent. It can be assembled by two men in day.

Description: Dome is 12½′ tall, weighs 415 lb, and provides 352 sq ft of usable floor space. Incorporating geodesic

Two men can assemble dome in a day

design, shelter is formed from prefabricated, resin-coated triangular panels of ½″-thick board ("sandwich" of rigid foam plastic bonded between sheets of heavy, water-resistant Kraft). Panels are bent and folded together at site.

It comes equipped with hinged double door, window openings and ceiling vents. Foundation consists of wooden base ring to which dome is bolted. Ring is staked to ground for permanence.

(Geospace dome shelter is manufactured by Filtered Rosin Products Company, subsidiary of Monsanto Chemical Company, Baxley, Ga.)

Check 1317 opposite last page.

Filter-regulator offers high capacity-to-droop, dead tight shutoff

Uses: Unit is recommended for air pressure regulation and filtering in pneumatic systems.

Features: Regulator uses an extremely sensitive, diaphragm-spring combination to provide a high capacity-to-

droop ratio. Valve provides tight dead-end shutoff.

Description: Valve can be used at inlet pressures up to 150 psig and is available in four controlled-pressure ranges from 0 to 125 psig. One-piece inner valve is fabricated from Delrin 500. This material has resiliency and elasticity to provide a tight-sealing soft seat.

Filtration is provided by a 40-micron cylindrical filter made of phenolic-resin-impregnated cellulose. At 100 psig inlet pressure and 20 psi outlet pressure, capacity is 14.75 scfm with only a one psig droop. Entire regulator can be completely dissassembled merely by removing cap screws.

(Type 467 Airset filter-regulator is a product of Kieley & Mueller, Incorporated, 64 Genung St., Middletown, New York.)

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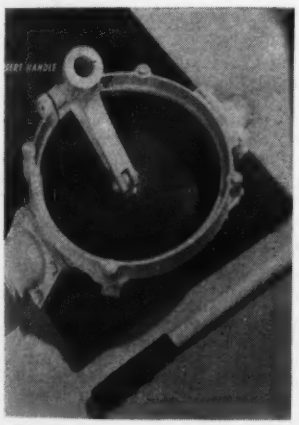


Gallon-per-stroke pace

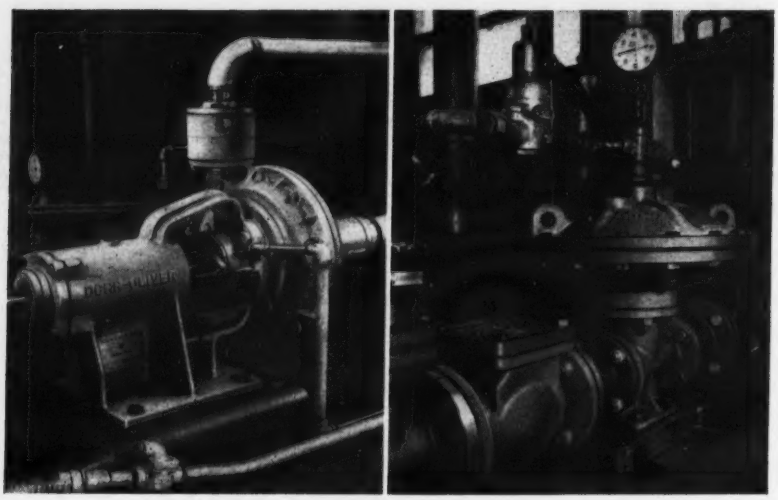
. . . is possible with self-priming hand pump that can be set up quickly to deliver 30 gal/min. It will move water, chemicals, petroleum products, sewage and can handle a high percentage of solids. Pump is fabricated of cast aluminum with neoprene diaphragm and valves. It weighs 20 lb.

(Diaphragm pump is development of Protek Specialty Company, Box 194, Bellaire (Houston), Tex.)

Check 1320 opposite last page.

DORR-OLIVER SPECIALIZED PUMPS

solve widely different problems at Vanderbilt Chemical



Important end products at Vanderbilt Chemical Corporation, East Norwalk, Conn., are metallic based dimethyldithiocarbamates and diethyldithiocarbamates for use in natural rubber and butadiene styrene rubber products.

Processing operations involve problems requiring two entirely different types of pumps, each adapted for highly specialized service. Vanderbilt Chemical solves these problems with the two Dorr-Oliver pumps shown above. At left is the Olivite® lined centrifugal, designed for safe handling of highly corrosive and similar problem liquids. At right is the ODS® diaphragm type pump, designed for transfer of slurries with a high percentage of suspended abrasives.

Twelve Dorr-Oliver units are now in operation at Vanderbilt Chemical – all with the trouble free, low maintenance characteristics inherent in equipment of Dorr-Oliver design and manufacture. Dorr-Oliver is the only major manufacturer offering three distinctly different pumps designed for chemical process applications – the lined Olivite centrifugal, alloy centrifugal, and ODS diaphragm type.

For full information on the right unit for your special application, write to Dorr-Oliver Incorporated, Stamford, Connecticut.

DORR-OLIVER

WORLD-WIDE RESEARCH • ENGINEERING • EQUIPMENT

AT THE CHEM SHOW—Dorr-Oliver Booth 531

Check 1322 opposite last page.

ENGINEERING & SAFETY

Valve orifice opening never a mystery in new design

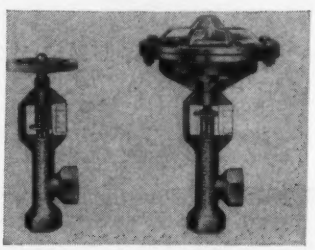
Operating threads outside preclude corrosion, galling

Uses: Valve applications where visual indication is needed.

Features: Valve has outside indicator allowing orifice position to be easily seen. Orifice can be set with accuracy and locked with optional handle. Threads are located outside valve packing and never come in contact with flowing medium. This precludes corrosion and thread galling.

Description: Indicator valve incorporates O-ring-style packing. In this manner, interior dead space is almost completely eliminated. Standard tightenable packing gland is optional.

The valves come in sizes of ⅛ to 4". They have a variety of standard tips and seats for various flow requirements.



Indicator valves have outside indicators allowing orifice positions to be easily seen. Model on left is manually operated, while that on right is air-operated

Stainless steel, carbon steel with stainless-steel trim, and bronze are standard materials. Pressure ratings are to 10,000 psi, working pressure.

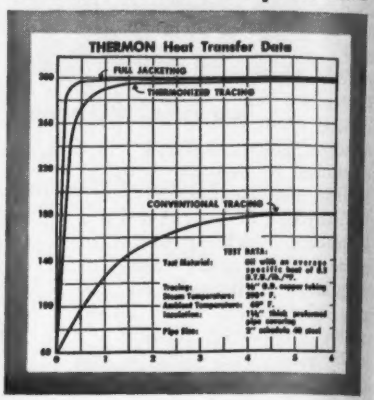
(Indicator valves are product of Flow Systems, Inc., 413 Poinsettia St., Box 444, Corona Del Mar, Calif.)

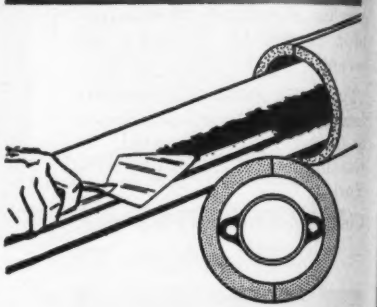
Check 1323 opposite last page.

For more information on developments reported in this section, check corresponding numbers on Reader Service Slip opposite last page of this issue.

THERMON

the proved solution to HEAT TRANSFER problems





Wherever heat transfer is a problem, non-metallic, adhesive Thermon Heat Transfer Cement, with its highly efficient heat transfer properties, usually can effect a solution. Approximately 5,000 different users, with hundreds of applications, have realized savings of up to 90% with Thermon.

Thermon can easily be applied over both steam tracing and electrical resistance systems, and is equally effective for heating and cooling operations.

Thermon's heat transfer characteristics are approximately *11 times* superior to those of steam tracing, and almost equal those of steam jacketing. Almost without exception, Thermon can be used in place of expensive steam jacketing—and can often be applied where steam jacketing is impossible. Up to 90% of the cost of steam jacketed equipment has been saved through use of Thermon.

Write for Thermon Bulletin 300.

See our exhibit, Booth 1207 28th. Exposition of Chemical Industries New York Coliseum Nov. 27-Dec. 1, 1961

THERMON MANUFACTURING CO.

1017 Rosine • P. O. Box 1961 Houston, Texas

Check 1324 opposite last page.

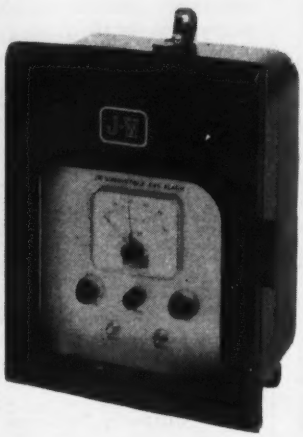
SAFETY SLANTS.

hazardous chemicals.

Spray bars in standby position are up and out of the way. A swing-down motion actuates a quick-opening valve and releases an instantaneous 8 x 8" flow of water. Volume is controlled by loose key stop. Water consumption is between 8 and 10 gpm on between 10- and 20-psi flow pressure.

(Swing-down emergency fountain is product of Logan Emergency Showers, Inc., Box 111, Glendale, Calif.)

Check 1326 opposite last page.



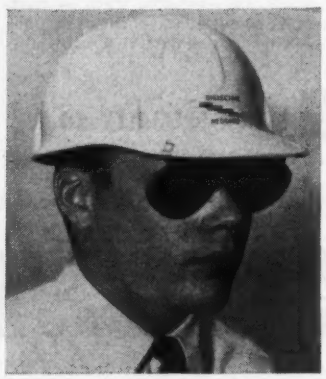
Combustible gases found

. . . by means of diffusion sampling with diffusion-head-type alarm for continuous monitoring of hazardous locations for presence of natural gas, LPG, and other combustible gases and vapors.

Alarm is priced under $500. It can be modified for special requirements such as rack mounting and multi-point monitoring. It is also available in an explosion-proof housing.

(Combustible-gas alarm RH is product of Johnson-Williams, Inc., Palo Alto, Calif.)

Check 1325 opposite last page.

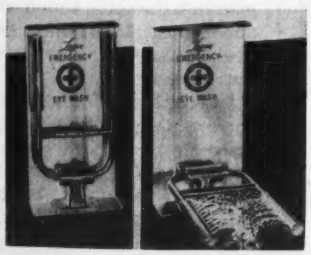


Hollywood hard hat

. . . is result of attaching plastic flip-up visor to conventional hard hat. Visor is constructed of 0.030 acetate bound on edges. It is available in choice of clear or green, and is adjustable for proper distance from wearer's face.

(Visor is delineated in Bul 1421—Davis Emergency Equipment Company, 47 Halleck St., Newark, N.J.)

Check 1327 opposite last page.



Swing down, splash up

. . . is motion of emergency eye, nose and mouthwash fountain providing first-aid for facial contamination and effects of acids and other

Safe practices and procedures for entering tanks and other enclosed spaces are considered in eight-page pamphlet which is 10th in MCA's Safety Guide series. It emphasizes that hazards inherent in tank entry can be avoided or overcome by following three basic principles. Copies of Pamphlet SG-10 are available at 30c each from the Manufacturing Chemists' Association Inc., 1825 Connecticut Ave., NW, Washington 9, D.C.

Screen changing speeded by tensioning device

Greater flexibility in operation and maintenance of wire cloth and plate decks on vibrating screens is possible with tensioning device. Fastener makes it possible to change screen decks in a fraction of

Device permits tensioning of cloth while screen is in operation

time formerly required and permits tensioning of cloth while screen is in operation.

One size fits all sizes and types of vibrating screens, greatly simplifying stocking of parts. A 1¼" adjustment on each side of desk, 2½" overall, is provided.

(Tensioning device for vibrating screens is a product of Allis-Chalmers Mfg. Co., Milwaukee 1, Wis.)

Check 1332 opposite last page.

Viscous liquids, slurries pumped without woe

Uses: Pumping extremely viscous liquids which must be moved under pressure.

Features: Pump is self-priming. Pumping action starts and stops almost instantaneously. The stator is its only moving part.

Description: Progressing-cavity pump is available in thirteen sizes with capacities to 26 gpm, for discharge pressures to 350 psig. Auxiliary fittings at both ends allow suction from several supply sources and/or delivery to several lines simultaneously at differing pressures.

(SRM pumps are product of Associated Engineers, Inc., Box 1628, Springfield, Mass.)

Check 1333 opposite last page.

Bronze repair compound lengthens pump life, salvages castings

Three-weeks delay, $600 are saved in repair

Uses: Material has been successfully field tested for filling large blow holes and other imperfections in bronze and brass castings. Worn pumps and valves may be rebuilt for extended service life.

Features: Supplier reports that a pump manufacturer saved $600 and three week's shipping delay by using repair compound on four large castings which had been machined incorrectly. Material bonds to iron, bronze, steel, aluminum, brass, wood, glass and many other surfaces.

Description: Repair compound consists of 80% bronze, and 20% plastic (epoxy) activated by a hardening agent. Tensile strength of cured material is 9000 psi; compression strength 20,000 psi. Shrinkage during hardening is 0.0005" per inch.

(Devcon BR bronze repair compound is a product of Devcon Corp., Danvers, Mass.)

Check 1334 opposite last page.

Paper towels for industry re-usable and disposable

Uses: Wiping bearings, cleaning gears, polishing gages, soaking up spillage and similar industrial applications.

Features: First heavy-duty paper shop towel designed to be re-usable. Towels cost approximately one cent each.

Description: A wood cellulose product, towels are said to be lint-free and have high tensile strength and quick absorbency. Saturated with solvent, they may be used to clean machine tools or pick up chips and shavings.

Towels, unfolded, measure 13 x 15". Metal dispensers are available.

(Kimtowels are development of Industrial Products Division, Kimberly-Clark Corporation, Neenah, Wis.)

Check 1335 opposite last page.

'Do-it-yourself' service for make-up-air conversions

A complete make-up-air do-it-yourself service is now available to plant engineers who wish either to convert their present make-up-air system from steam or hot water to gas-fired, or to utilize components salvaged from previous air-moving installations in new gas-fired system.

Burner sections, equipped with controls and control panels wired and piped ready for installation, are available. Sections may be arranged for horizontal or vertical mounting. Nine sizes are made in Btu/hr capacities in 1,875,000 to 6,000,000 range. Fan capacities, when furnished with burner sections, are in 20,000- to 60,000-cfm range.

(Further information on make-up-air do-it-yourself service is available from Metals Engineering & Mfg. Co., Inc., 8824 Lyndon, Detroit 38, Mich.)

Check 1338 opposite last page.

Teflon makes its debut in formulated-spray-finish and dispersion forms

Teflon fluorocarbon resin can now be obtained as a dispersion or as formulated spray finishes.

Dispersion is expected to find application as Class-H impregnant and surface coating for wire and cable, component installation and chemical applications.

It is a water-base dispersion containing 6½ lb of finely divided fluorocarbon-resin solids per gal.

The fluorocarbon-resin spray finishes are said to offer improved corrosion protection in surface coatings. They are available in enamel green and clear. Finishes may be fused at 575 to 625°F.

(Teflon TE-9500 FEP dispersion and Teflon FEP spray finishes are products of E.I. Du Pont de Nemours & Company, Inc., Wilmington, Del.)

Check 1339 opposite last page.

A NEW SOLUTIONS ARTICLE

'Air houses' are used to deflate the costs of tire storage

Air-inflated buildings are being employed by The B. F. Goodrich Company in Los Angeles to store passenger tires. Storage costs are expected to be lower by as much as 80% by the buildings which provide warehouse space for 60,000 tires.

Each structure contains 226,195 cu ft and is 180′ long, 60′ wide and 30′ high. They are shaped like quonset huts with round ends. Both were erected and ready for service in two days.

A three-hp electric motor with 30″ fan runs 24 hr/day to keep each air house rigidly inflated at ½ lb of pressure

per sq ft. In case of electric-power failure, auxiliary gasoline engine is activated to maintain same air pressure.

It is estimated that tire-warehousing costs after first year initial cost will be about 80% lower than leasing space in permanent buildings. Air houses can be deflated, moved to a new location or rolled into a small bundle for storage in a few hours.

The buildings were manufactured for B. F. Goodrich by CID Air Structures Company of Chicago. The inflatable airtight and watertight material is 6-¼-oz Nylon fabric coated with Geon vinyl resin supplied by B. F. Goodrich Chemical Company, a BFG Division.

Centrifugal - pump installation, servicing and maintenance is topic of discussion of 18-page bulletin, including information on storage, foundation construction, alignment, pipe, priming and starting, lubrication, trouble-shooting and basic servicing, and internal inspection. Bul G-2971—Worthington Corporation.

Check 1342 opposite last page.

NEWARK WIRE CLOTH

We offer more than 1000 different wire cloths, with varying mesh, wire diameter, metal and weave ...all with some fifty years experience in back of our modern manufacturing methods.

In short, Newark is a reliable source of supply for your wire cloth requirements.

NEWARK TESTING SIEVES

Send for our new Bulletin F-S-61 with the new 1961 sieve standards...

New testing sieve standards have been set by ASTM, NBS and ASA...and are in the planning stage for world-wide adoption. All of the specification data in our new bulletin, just off the press, conform to these new standards. This bulletin will be a good one to have in your file anyway, **but if you are in the market now for sieves and/or sieve shaker, you can get all the information you need for ordering.**

Newark Wire Cloth COMPANY

351 Verona Avenue • Newark 4, New Jersey
Teletype: NK607 • Tel.: HUmboldt 3-7700
Representatives in all principal industrial areas

Check 1344 opposite last page.

NEW LITERATURE
Plant Engineering, Safety and Fluids Handling

High-pressure equipment — including pumps, compressors, check valves, stop valves, fittings, vessels and gas filters — for service up to 75,000 psi is illustrated and described in 32-page technical brochure — McCartney Manufacturing Company, Inc.

Check 1345 opposite last page.

Self-sealing-couplings uses in pipe systems are considered in 20-page bulletin discussing basic applications possible. It is well illustrated with drawings. Bul 629—Aeroquip Corporation.

Check 1346 opposite last page.

Spiral-bevel speed reducers of both horizontal and vertical types are dealt with in 32-page bulletin, covering data on basic types, special features of vertical types, applications, selection procedure, and other topics. Bul J-25—Hewitt-Robins.

Check 1347 opposite last page.

High-pressure seals and fasteners are taken up in 16-page catalog, which, for each product in line, gives dimensional drawings, part numbers, complete specifications and other technical data. Cat 359B — A.P.M. Corporation.

Check 1348 opposite last page.

Spiral-wound gaskets which are available in asbestos- Teflon- and ceramic-filled types are covered in 20-page bulletin including detailed description, specification and ratings for each one in line. Guardian Gaskets Bul—Garlock Inc.

Check 1349 opposite last page.

Variable-speed sheaves are pictured and described in 16-page bulletin, explaining design concept which eliminates freezing and sticking from corrosion and allows sheaves to run indefinitely at one speed. Bul 25103 — T.B. Wood's Sons Co.

Check 1350 opposite last page.

Air - compressor line, including both gasoline- and electric-driven models are illustrated and described in 20-page catalog. Cross-sectional view of basic compressor and loadless starting device is included in Cat 20—Lincoln Engineering Co.

Check 1351 opposite last page.

Compression tube fittings featuring reversible ferrules are specified in 20-page Cat 4323—Parker Fittings & Hose Division, Parker-Hannifin Corporation.

Check 1352 opposite last page.

On the Boiler Feedwater lines in a large eastern paper mill . . .

Williams-Hager Silent Check Valves provide positive protection against surge pressures and resulting water hammer. Silent in service and rugged in construction, Williams-Hager check valves operate effectively regardless of their installation position.

Write for Bulletins: No. 654 on Valves; No. 851 on Cause, Effect and Control of Water Hammer; No. 659 on Pressure Loss Tests.

WILLIAMS • HAGER
Silent
Check Valves

The Williams Gauge Company, Inc.
146 Stanwix Street • 2 Gateway Center
Pittsburgh 22, Pa.
Our 75th Year • 1886-1961

Check 1353 opposite last page.

Sanitary fittings and valves are taken up in four bulletins. Threaded fittings and valves, butt-weld fitting and valves, I-line fittings and valves, and automatic valves are presented, respectively, in 20-page Bul G-613, six-page Bul G-614, four-page Bul G-615, and eight-page G-616—Cherry-Burrell Corporation.

Check 1354 opposite last page.

Determining economic thickness of insulation is subject of new, expanded edition of the manual on economic thickness of insulation originally prepared by Union Carbide Chemicals Company and West Virginia University. Manual is applicable to practically all heat-using facilities.

Original manual, which was not available to public, was first practical reduction to charts and tables of the numerous unwieldy variables that prevented simple calculation of exact thickness of thermal insulation to give optimum return on investment over the years. Copies of 180-page manual, "How to Determine Economic Thickness of Insulation," are available at $8.00 each from the National Insulation Manufacturers Association, 441 Lexington Ave., New York 17, N. Y.

Fire-retardant treatments of building materials is subject of six-page guide which is first standard on methods of reducing flame-spread properties of building materials. It deals with both pressure impregnation and use of surface coatings. Copies of NFPA Guide 703 are available at 40c each from the National Fire Protection Association, 60 Batterymarch St., Boston 10, Mass.

"Some comedian in a helicopter from the Anti-Smoke Committee."

manufacturers' current literature

This section features a variety of literature currently available from manufacturers. See also the other sections in this issue for new literature pertaining to those particular sections

Corrosion Control

Sealless plastic pumps, have capacity range to 40 gpm and operate in temperature range of −60 to +350°F. They are specified in Cat 10 — Vanton Pump and Equipment Corp., Division of Cooper Alloy Corporation.

Check 1357 opposite last page.

Penton is subject of two publications. Complete listing of suppliers of valves, pipe and fittings, pumps, meters, tank linings and coated parts made with Penton . . . and ratings of Penton's performance at temperatures to 250°F when exposed to over 300 chemicals and reagents . . . are topics, respectively, of "The Penton Buyer's Guide" and "The ABC's of Penton for Corrosion Resistance." — Hercules Powder Company, Incorporated.

Check 1358 opposite last page.

Teflon-jacketed gaskets for glass-lined equipment have ends which are butt-welded instead of overlapped. They are among styles considered in Cat AD-154 — Garlock Inc.

Check 1359 opposite last page.

Glass pipe and fittings are taken up in Bul PE-3 — Corning Glass Works.

Check 1360 opposite last page.

Corrosion-resistant-valve line includes 150-psi stainless-steel horizontal swing check model, 150-psi stainless-steel globe version, and 150-psi stainless-steel Y unit . . . among others. Corrosion-resistant Valves — The Wm. Powell Company.

Check 1361 opposite last page.

Flexible braided-metal hose has corrosion-resistant Telflon core. Hose is depicted in Bul 5 — Timely Technical Products, Inc.

Check 1362 opposite last page.

Throttlable plastic gate valves are available in sizes of ½ to 2" and rated for service to 150 psi. Full story is contained in Cat 42 — Vanton Pump and Equipment Corp., Division of Cooper Alloy Corporation.

Check 1363 opposite last page.

Corrosion-resistant long-tangent elbows are specified in Speedline Cat Information — Horace T. Potts Company.

Check 1364 opposite last page.

Chemical Materials

Economical use of carbon dioxide is discussed in Carbon Dioxide Booklet — Chemicals Division, Olin Mathieson.

Check 1365 opposite last page.

Thionyl chloride can be used to introduce either sulfur or sulfur and oxygen. It is available in technical grade of 93%-pure, minimum, and refined grade of 98.0% minimum purity. Properties are outlined in Thionyl Chloride Data Sheet — Hooker Chemical Corporation.

Check 1366 opposite last page.

Hydrofluoric acid is available for shipment from three production facilities and five bulk-storage plants. HF Information may be obtained from General Chemical Division, Allied Chemical Corporation.

Check 1367 opposite last page.

Silicone defoamers are effective with many materials in ratio of one-part silicones solids per ten-million parts foamer. These are subject of Silicone Defoamers Data — Dept. 2722a, Dow Corning Corporation.

Check 1368 opposite last page.

m-Phenylenediamine is subject of a 36-page technical bulletin presenting properties, reactions and suggested uses . . . all keyed to 278-reference bibliography. Tech Bul I-23 — National Aniline Division, Allied Chemical Corporation.

Check 1369 opposite last page.

A 12-carbon ester-alcohol (2,2,4-trimethyl-1,3-pentanediol monoisobutyrate) is used by manufacturer to make own plasticizer and also is offered for sale. For more information see Texanol Data — Eastman Chemical Products, Inc., Subsidiary of Eastman Kodak Company.

Check 1370 opposite last page.

Phosphorus oxychloride can be used as a catalyst for intermediates and dyestuffs, and in preparation of medicinals such as sulfa drugs. Complete information is contained in Phosphorus Oxychloride Data — Hooker Chemical Corporation.

Check 1371 opposite last page.

Mineral products, such as silicas, tamart, red oxides and mineral black, are topic of Mineral Products Specifications — Dept. CP-101 — Tamms Industries Co.

Check 1372 opposite last page.

Chlorinating agents, including thionyl chloride, sulfuryl chloride and phosphorus oxychloride, are presented in Bul 328-B — Hooker Chemical Corporation.

Check 1373 opposite last page.

Plastic additives are intended to give longer life, better wear and less discoloration and minimal brittleness. Light absorbers, antioxidants and antistatics are all available. Intermediates Dept., American Cyanamid Company.

Check 1374 opposite last page.

Hydrogen-peroxide data may be obtained from Dept. CP-61-13, Becco Chemical Division, Food Machinery and Chemical Corporation.

Check 1375 opposite last page.

Sulfuryl chloride can provide faster chlorination than elemental chlorine, in some situations. The 99%-pure product has no flah or fire point. .Full story is contained in Sulfuryl Chloride Data Sheet — Hooker Chemical Corporation.

Check 1376 opposite last page.

Diacyl, dibasic-acid, ketone, and aldehyde peroxides . . . and alkyl peroxyesters, alkyl peroxides and hydroperoxides, and diperoxide derivatives . . . are all considered in Peroxides Data Sheets — Lucidol Division, Wallace & Tiernan Inc.

Check 1377 opposite last page.

Drying and Heating

Ovens and dryers are made in batch and conveyor types for service to 1000°F, in gas, electric, steam, oil and radio-frequency power models. They are covered in Bul 157 — Young Brothers Co.

Check 1378 opposite last page.

Boilers, of water- and fire-tube design and packaged units are manufactured by Boilers Division, Struthers Wells Corporation.

Check 1379 opposite last page.

Check 1380 opposite last page.

Check 1381 opposite last page.

CURRENT LITERATURE

Heat processing equipment, including rotary dryers, calciners, coolers, kilns and multiple-hearth furnaces, is produced by Process Engineering Division, Bartlett-Snow-Pacific, Inc.

Check 1382 opposite last page.

Water-tube boilers, vapor-steam superheaters and liquid-phase heaters, are delineated, respectively, in Modulatic, Superheaters and High-R-Temp Information — Dept. 3-I, Vapor Heating Corporation.

Check 1383 opposite last page.

Apron conveyor dryers can be utilized for processing variety of products, including pharmaceuticals, synthetic fibers, hair, rubber crumb, starch, foods and the like. — The National Drying Machinery Co.

Check 1384 opposite last page.

Air-cooled oil coolers and liquid-cooled heat exchangers of fixed-tube-bundle and removable-bundle types are presented, respectively, in Cats 3560, 1261 and 1160 — Dept. J-371, Young Radiator Company.

Check 1385 opposite last page.

Pilot-plant series of liquid-phase heat-transfer systems operating at high temperatures and low pressures, is detailed in Bul 597 — Parks-Cramer Company.

Check 1386 opposite last page.

Process Instrumentation

Metering data is tabulated in 28-page technical bulletin listing liquids, helping to pick proper sizes and naming features of meters in 2- to 2000-gpm range. Second publication contains all specifications. Meter Bul 566SP and Spec Guide 566B — Liquid Meter Division, Neptune Meter Company.

Check 1387 opposite last page.

Null-balance potentiometer pyrometer weighs 3½ lb and measures 4x5x6". It provides ¼ of 1% of scale accuracy and incorporates 23.6" double-range scale. Unit measures temperatures in range of −450 to +3200°F. More information is contained in Instrument Section 64-5 — Thermo Electric Co., Inc.

Check 1388 opposite last page.

Rotameters each have frame made of one rigid piece. End fittings rotate through 360°. They meter to 310 gpm water or 1300 scfm air over range of at least 10 to 1. Additional specifications are contained in Varea-meters Information — Dept. V-7.22 — Wallace & Tiernan Inc.

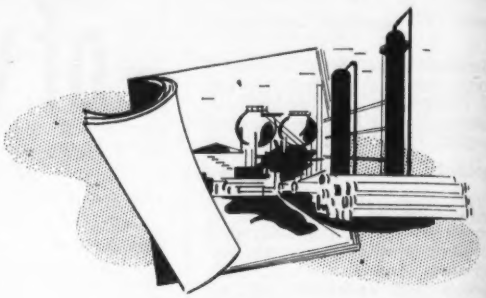
Check 1389 opposite last page.

▶ A NEW SOLUTIONS ARTICLE

A NEW SOLUTIONS FEATURE

"New Solutions" articles —

PLANT TOURS



AT YOUR DESK

In these days of the "profit squeeze" . . . and the push for ever lower operating costs . . . how often have you wished for the opportunity to swing through other plants to see how THEY are attacking and solving the same problems YOU have? Trouble is, of course, that you're up to your ears in every-day, urgent tasks that keep you pretty well confined to your own plant.

Well . . . the "New Solutions" articles appearing every month in *CHEMICAL PROCESSING* magazine are designed just for busy men such as you. Each one is, in effect, a guided plant tour you can take without even leaving your desk!

Here are objective, concise reports (often two dozen per issue) that "take you by the hand" and show you how specific manufacturers have matched wits with and won out over some tough processing problems. They're geared to what's happening NOW in moves toward increased efficiency and lower costs in all segments of the operational picture.

You'll find them throughout each issue of *CHEMICAL PROCESSING*. Look for their identification by the "trademarks" shown at the top of this page.

Why not thumb through this issue now? Chances are you'll find an answer to that "toughie" that's been plaguing you for weeks!

CURRENT LITERATURE

Tape-programmed gas chromatograph incorporates motor-driven transparent film in conjunction with photo-electric transmitter and receiver to provide any combination of time and sequence requested. A bulletin may be obtained from Instrument Division, Mine Safety Appliances Company.

Check 1390 opposite last page.

High-pressure gages are available in in through-vision and reflex models. Strahman Valves Inc.

Check 1391 opposite last page.

Instrument line is presented in 28-page bulletin, explaining manufacturing facilities and presented product line, including differential-pressure instruments, pressure and temperature instruments, accessories and liquid-level controllers. Bul G-61 — Industrial Instrument Corporation.

Check 1392 opposite last page.

Fluid-control equipment is available for severe conditions in nuclear and cryogenic fields. Fisher Governor Company.

Check 1393 opposite last page.

A **portable data-processing trailer** is now available for leasing for on-site on-line application with a process. Data on tape is then ready for direct entry into a general-purpose computer. Dresser Electronics.

Check 1394 opposite last page.

Liquid meters are available for batching, blending and controlling of formulas. Liquid Meters — Dept. 131K, Rockwell Manufacturing Company.

Check 1395 opposite last page.

Process-control-computer system is looked at in 16-page bulletin describing a basic system and discussing various applications. Bul GEA-7523 — Process Computer Section, General Electric Co.

Check 1396 opposite last page.

Flow-control systems incorporate level controls and air-operated automatic throttling valves. Alloy Products Corp.

Check 1397 opposite last page.

Liquid-level control incorporates magnetic proximity switch utilizing a permanent Alnico-V magnet. Information on the unit is available from Dept. A, Jo-Bell Products, Inc.

Check 1398 opposite last page.

Temperature recorders, pressure and vacuum recorders and indicating thermometers are described and drawn in four-page Form G-194-9-59 — General Products Group, The Electric Auto-Lite Company.

Check 1399 opposite last page.

CURRENT LITERATURE

Large-chamber gages are designed to indicate levels of liquids whose tendency to boil and flash makes accurate readings difficult. These and other models are reviewed in Gages Information — Jerguson Gage & Valve Company.

Check 1404 opposite last page.

Air-control temperature-regulating system in a recent installation provided ∓5°F accuracy under wide and instantaneous load swings of 210 to 80 gpm. Full story on systems of this type is contained in Bul 9 — Spence Engineering Company, Inc.

Check 1405 opposite last page.

Mercury actuated temperature-indicating instruments of all types are tabulated in Thermometers Cat — Palmer Thermometers, Incorporated.

Check 1406 opposite last page.

Bin-level control is expanded upon in literature published by The Bin-Dicator Co.

Check 1407 opposite last page.

Continuous in-line blending is subject of eight-page bulletin presenting diagrams of typical systems and photographs and descriptions of several installations. Bul 650 — Blackmer Pump Co.

Check 1408 opposite last page.

Processing Equipment

Demineralizers, of mixed-bed, two-bed and four-bed types, are tabulated in Cat 160 — Barnstead Still and Sterilizer Co.

Check 1409 opposite last page.

Vacuum and quick-cooling pans for 10- to 500-gal and 50- to 200-gal capacities, respectively, are subjects of two bulletins published by Lee Metal Products Company, Inc.

Check 1410 opposite last page.

Kettles, including standard-jacketed, 80- to 300-gal, standard-jacketed 5- to 500-gal, standard-jacketed 5- to 100-gal, center-line scraper-agitator 80- to 300-gal, full-jacketed 10- to 300-gal, and standard jacketed 40- to 200-gal, are subjects, respectively, of CW, A, C, CW3T, B, and Pressure Kettles Buls — Lee Metal Products Company, Inc.

Check 1411 opposite last page.

Mixers, of portable, side-entering and top-entering, and turbine types are subjects, respectivelv, of Buls 530, 620 and 1210 — Dept. P Mixer Division, Eastern Industries, Inc.

Check 1412 opposite last page.

Pulp tanks, for capacities of 500 to 2000 gal, and storage tanks, which contain 100 to 5000 gal, are considered in two bulletins put out by Lee Metal Products Company, Inc.

Check 1413 opposite last page.

Ejectors, jet-vacuum equipment, fume scrubbers and cooling units are developed with the aid of extensive testing facilities by Croll-Reynolds Co., Inc.

Check 1414 opposite last page.

Bins, tanks and hoppers for storage or process, in lined or unlined models, are fabricated to order by Kirk & Blum.

Check 1415 opposite last page.

Processing equipment, including crystallizers, direct-fired heaters, evaporators, heat exchangers, mixing and blending units, quick-opening doors, and carbon and alloy processing vessels, are all turned out by Processing Equipment Division, Struthers Wells Corporation.

Check 1416 opposite last page.

Dimple-jacketed tanks and reactors are available in sizes of 2 to 12′ in diam, with lengths limited only by shipping restrictions. All units are certified to 162 psi, ASME. For more information see Standard Reactors Bul — Brighton Corporation.

Check 1417 opposite last page.

Water-bed steel-belt coolers are available with belts up to 48″ in width. Steel-belt Coolers — Steel Belt Conveyor Department, Sandvik Steel, Inc.

Check 1418 opposite last page.

Ion-exchange equipment, in which resin bed is exhausted or loaded by downward flow of liquid, and then regenerated or stripped by a downward flow of acid or alkali, is subject of Counterflow Information — Illinois Water Treatment Co.

Check 1419 opposite last page.

Materials Handling

It takes two minutes to precision-weigh a 600-lb batch of six materials in graphite department of Dow Chemical with batch weigher. Line is covered in Select-O-Weigh Tech Bul — Richardson Scale Company.

Check 1420 opposite last page.

Vibrators, for bins, chutes and hoppers, vibrating conveyors, and vibrating tables are topic of Vibrating Equipment Information — The Cleveland Vibrator Company.

Check 1421 opposite last page.

Invertable bulk-material bin can be attached to fork trucks or floor- or sling-type inverters. Invert-A-Bins — Dept. 703-9, The Powell Pressed Steel Company.

Check 1423 opposite last page.

Railroad cars for shipping dry powder or granular materials unload by any means of conveying. Airslide Cars — Airslide and Dry-Flo Car Division, General American Transportation Corporation.

Check 1424 opposite last page.

Bulk-handling systems are topic of facts available from Fluidizer Division, Daffin Corporation.

Check 1425 opposite last page.

Separation and Size Reduction

Dust-recovery equipment, including collectors, cyclones, scrubbers and filters for variety of applications, is presented in Bul A-9159 —The Ducon Company Incorporated.

Check 1426 opposite last page.

Long-tube vertical evaporators have all controls in open. A technical bulletin on them may be obtained from Swenson, Division of Whiting Corporation.

Check 1427 opposite last page.

Classifiers have instant cut-point adjustments and may be operated in series for several fractions. They are specified in Classifiers Details — Dept. 11-I, Buell Engineering Company.

Check 1428 opposite last page.

Horizontal pressure filters have been applied to filtration of a solution at ph 5.5, 180°F, sp-g 1.3, containing 0.4% solids (by weight). For full story, see Application Report 100P-12-N-7 — Industrial Filter & Pump Mfg. Co.

Check 1429 opposite last page.

Desludgers are available in full line of automatic solids-discharging centrifuges with capacities of of 100 to 6500 gph. Westfalia Desludgers — The Centrico Incorporated.

Check 1430 opposite last page.

In gas scrubber, gas is drawn upward through perforated plate then divided into thousands of jets. Each strikes wetted impingement surface directly above, bounding and rebounding against various grid surfaces. Turbulent intermixture of gas pressure and liquid causes complete saturation. Complete information is contained in Impinjet Cat — The W. W. Sly Manufacturing Co.

Check 1431 opposite last page.

CURRENT LITERATURE

Horizontal-plate-filtering efficiency has been combined with convenience of vertical-plate cleaning in a filter design. HRC Filters — Sparkler Manufacturing Company.

Check 1435 opposite last page.

Air-swept grinding systems cannot be jammed or damaged by tramp iron or other foreign material. The Kennedy Van Saun Manufacturing & Engineering Corporation.

Check 1436 opposite last page.

Centrifuges for intermediate- and low-vapor-pressure applications, can handle slurry of solids contents of ½ to 50% and solid particles in range of ¼ to few microns in size. Full story is contained in P-3000 Super-D-Canter Details — The Sharples Corporation.

Check 1437 opposite last page.

Diatomite filter aids are available in variety of standard and special grades for needed degree of clarity. Additional information is contained in Celite Details — Johns-Manville.

Check 1438 opposite last page.

Horizontal-tray-filter line includes small units in which trays may be removed by hand and filter cakes dumped . . . and large units in which groups of trays may be rolled out and mechanically rotated to dump cakes or rotated inside tank to drop cakes into built-in hopper bottoms, for reslurrying or for removal as solids by scroll conveyors. Specifications are included in Bul 152 — T. Shriver & Company, Inc.

Check 1439 opposite last page.

Screens which are of all-stainless-steel all-welded construction can be installed on present owned equipment. Bee-Zee Screens — The Bixby-Zimmer Engineering Company.

Check 1440 opposite last page.

Packaging

Plastic liners, for sealed drums, fiber containers, cartons and boxes, are available in all sizes and styles in polyethylene and all flexible films. They are subject of manual, "Facts and Figures" — Protective Lining Corp.

Check 1441 opposite last page.

Valve-bag packers are designed to handle free-flowing reasonably dry, granular or powdered materials in bags weighing from 25 to 100 lb, packed weight. They are further detailed in Bag Packers Information — Black Products Company.

Check 1442 opposite last page.

Automatic bag packers require no outside motivations, such as electricity or compressed air. Details may be obtained from Raymond Bag Corporation, Division of Albemarle Paper Mfg. Co.

Check 1444 opposite last page.

Plant Engineering

Spiral reamers penetrate pipe, conduit, metal hose or wood. They are available for ⅛ to 4″ pipe and conduit. Spiral Reamers — The Ridge Tool Company.

Check 1445 opposite last page.

Axial compressors are taken up in 16-page bulletin, including detailed drawings of typical units, close-up photographs, photographs of installations and operating data. "Axial Compressors" — Sulzer Bros., Inc.

Check 1446 opposite last page.

Manual-impact wrenches are completely portable and need no outside power. Six models come in bolt sizes in range of ½ to 2½″. Swench Wrenches — Marquette Division, Curtiss-Wright Corp.

Check 1447 opposite last page.

Wire cloth is produced in any metal or alloy in any weave. Complete line is delineated in 120-page Wire Cloth Cat — Dept. F, The Cambridge Wire Cloth Co.

Check 1448 opposite last page.

Motor-starter is combination unit with fused disconnect switch. Second version incorporates ITE circuit breaker as disconnection method. Details are reviewed in Publication 6100 — Allen Bradley Co.

Check 1449 opposite last page.

Horizontal, balanced-opposed compressor offers choice of many crankthrows, cylinder arrangements and staging. Others are available for 7½- to 5000-hp applications, for vacuum service, and for pressures to 15,000 psig . . . motor or steam drive. Chicago Pneumatic.

Check 1450 opposite last page.

Heat-reclaiming systems are available in nine models with ratings of 40 to 1000 bhp. Details on the systems are reviewed in Tech Data and Cat 55-D — Fred H. Schaub Engineering Company.

Check 1451 opposite last page.

Anti-seize thread compound can be used in below-freezing weather. It is available in both tubes and cans, Fel-Pro C5-A — Dept. 54, Felt Products Mfg. Co.

Check 1452 opposite last page.

CURRENT LITERATURE

Non-lubricated piston compressors are available for capacities of 10 to 4000 cfm and discharge pressures to 650 psig. These, along with axial and centrifugal units, are covered in Compressors Information — Sulzer Bros. Inc.

Check 1455 opposite last page.

Floodlight's 1500-w lamp has 22-lumens/watt output, constantly through 2000-hr rating. Available in three beam spreads, it is specified in Bul QL 15-161 — Appleton Electric Company.

Check 1456 opposite last page.

Submerged-combustion systems heat or concentrate any liquid that can tolerate contact with clean products of combustion. They are outlined in Bul 115 — Thermal Research & Engineering Corp.

Check 1457 opposite last page.

Complete semi-conductor power-conversion equipment and systems, for any AC-to-DC application, are covered in Industrial Rectifier Guide — Meaker Company, Subsidiary of Sel-Rex Corporation.

Check 1458 opposite last page.

Force-feed lubricators automatically start, stop, speed-up and slow-down in synchronization with machinery. They are tabulated in Lubricators Cat — Manzel, Unit of Houdaille Industries, Inc.

Check 1459 opposite last page.

Fans have air-cooled shafts, each featuring chamber-and-slot design. They are specified in Bul 960 — Garden City Fan & Blower Co.

Check 1460 opposite last page.

Shaft-mounted speed reducers and screw-conveyor drives are tabulated in 60-page bulletin presenting extensive specification tables. Bul 60 — Dodge Manufacturing Corporation.

Check 1461 opposite last page.

Multi-purpose floodlights are available in eight models in open or enclosed styles, with two different beam spreads. They are considered in four-page Bul GF-860 — Appleton Electric Company.

Check 1462 opposite last page.

Floodlight which provides NEMA beam spreads I through V also includes 400-w mercury vapor unit. Specifications, photometric data and installation accessories on this floodlight are included in four-page Bul SF-960 — Appleton Electric Company.

Check 1463 opposite last page.

For more information on developments in the section, check the Reader Service Slip.

Safety

Protective-clothing line includes coats, aprons, overalls, gloves and footwear. It is depicted in Protective Clothing Details — Goodall Rubber Company.

Check 1464 opposite last page.

Explosion-proof panelboards are engineered to handle motor control, machinery, alarm, lighting and various circuitry requiring breaker capacities of 15, 20 or 30 amps. They are detailed in 28-page Bul 661 — Appleton Electric Company.

Check 1465 opposite last page.

Ventilator-exhausters, for exhausting welding fumes or foul air from enclosed vessels, are portable. For more information see Ventilator-exhausters Facts — Coppus Engineering Corp.

Check 1466 opposite last page.

Valves

Flanged ball valves are available in sizes of ¼ through 6". Seat and seal material options are Buna-N, Teflon and Neoprene (with other materials available on order). Technical information on the valves is published by Worcester Valve Co., Inc.

Check 1467 opposite last page.

Air-operated diaphragm-valve design allows for wide range of operator sizes. It is available in sizes of ½ through 16", with screwed, flanged, socket-weld and special end connections . . . for pressures to 150 psig and temperatures to 400°F. Complete selection data is contained in Bul 134-A — Hills-McCanna Company .

Check 1468 opposite last page.

Valve units for reciprocating pumps are made in 17 sizes. Designed to meet over 300 variations in installation requirements, their construction is throroughly explained in eight-page Form 400B — Durabla Manufacturing Company.

Check 1469 opposite last page.

Rubber-seat butterfly valves are taken up in four-page bulletin, fully describing and picturing models in size range of 3 to 144" for pressures of vacuum to 150 psi. Bul 6 — Henry Pratt Company.

Check 1470 opposite last page.

Diaphragm valves have working parts completely isolated from material in line to preclude corrosion and abrasion. — Grinnell Company.

Check 1471 opposite last page.

CURRENT LITERATURE

Ball and butterfly valves are available for quick delivery from local distributors. Lunkenheimer Company.

Check 1475 opposite last page.

Bronze globe valve incorporates resilient unplasticized resin insert providing full 360° seal against matching Monel seat. Also included is secondary metal-to-metal seating. It is explained in Globe Valve Bul — The Walworth Companies.

Check 1476 opposite last page.

Resilient-seated butterfly valves are expanded upon in Bul 590X — W. S. Rockwell Company.

Check 1477 opposite last page.

Ball-valve design, which isolates stem from fluid stream, is considered in Fluid Services Guide — Jamesbury Corp.

Check 1478 opposite last page.

Stainless-steel valves are available in types and alloys to satisfy most needs. They are indexed in Cat 59-SS — Jenkins Bros.

Check 1479 opposite last page.

Pinch valves each incorporate recesses in sleeve which serve as "hinges" during compression. They are available in sizes of 1 to 14" ID, for pressures to 150 psi and temperatures to 200°F. More information is contained in Cat 609 — Mine and Smelter Supply Co.

Check 1480 opposite last page.

Check valves; cause, effect and control of water hammer; and pressure-loss tests are subjects, respectively, of Buls 654, 851 and 659 — The Williams Gauge Company, Inc.

Check 1481 opposite last page.

"Yessir, the union did get us a raise last month, but now I'm trying to get one on my own."

CURRENT LITERATURE

Fluids Handling

Spray-nozzle systems can be tuned for maximum performance by proper selection of nozzles. A complete line is reviewed in Cat 24 — Spraying Systems Co.

Check 1485 opposite last page.

Screwed and socket-weld fittings are available for 150- through 6000-psi applications in stainless-steel construction, and for 2000-through 6000-psi service in forged steel. Line is indexed in Fittings Cat — The Camco Fittings, Incorporated.

Check 1486 opposite last page.

Spielvogel's simplified formula for quick pipe-stress calculations is described and applied in bulletin on welding elbows . . . with charts comparing modulus of elasticity of cast steels with forged steels over a range of normal operating temperatures. Bul 345 — WKM, Division of ACF Industries, Inc.

Check 1487 opposite last page.

Spray nozzles are topic of comprehensive catalog including complete performance data for each of hundreds of spray nozzles in line. Spray Nozzles Cat — Spray Engineering Company.

Check 1488 opposite last page.

Pump cups are available with 100%-Nylon composition for hydraulic controls, air cylinders and reciprocating pumps. Data on these are incorporated in Bul 5903 — Darling Valve & Manufacturing Co.

Check 1489 opposite last page.

Tube fittings have been installed in as high quantities as 10,000 to 20,000 per plant. Swagelok Tube Fittings — Crawford Fitting Company.

Check 1490 opposite last page.

Steam-trap case history, outlining solution of temperature-control problem in wine processing, is subject of Case History 185 — Sarco Company, Inc.

Check 1491 opposite last page.

Seven types of packings are claimed to take care of practically all maintenance requirements. Breakdown on this is contained on Big 7 Packing Chart — Packing Division, Raybestos-Manhattan, Inc.

Check 1492 opposite last page.

For more information on developments reported in this section, check corresponding numbers on Reader Service Slip opposite last page of this issue.

Check 1494 opposite last page.

Check 1495 opposite last page.

CURRENT LITERATURE

Gaskets, of ring, heat-exchanger and corrugated-metal types, are taken up, respectively, in Buls 563, 564 and 565 — Chicago-Wilcox Mfg. Co.

Check 1496 opposite last page.

Polypropylene tube can be used at temperatures of −100 to +300°F. It is indexed in Bul 301 — Imperial-Eastman Corporation.

Check 1497 opposite last page.

Steam-trap sizing, selection, installation and maintenance for any pressure, temperature or load is taken up in 48-page Cat K — Armstrong Machine Works.

Check 1498 opposite last page.

Forged-steel valves, fittings, flanges and unions are indexed in Cat F-10 — Dept. 24A-FCP, Henry Vogt Machine Co.

Check 1499 opposite last page.

Couplings are available in 308,754 different combinations of size, end fittings and materials. Detailed specifications and technical data are provided in Cat 60 — Snap-Tite.

Check 1500 opposite last page.

Pumps

Screw pumps designed for handling high-viscosity materials are available in capacities of one to 2600 gpm for viscosities of 32 to five-million ssu. Screw Pumps — Sier-Bath Gear & Pump Co., Inc.

Check 1501 opposite last page.

Vertical pump for handling molten chemicals is depicted in Bul V-837 — Taber Pump Co.

Check 1502 opposite last page.

"This side makes our product . . . the other side processes our waste streams before putting them in the river."

Check 1503 opposite last page.

Check 1504 opposite last page.

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SOUTHEASTERN STATES, 1776 Peachtree Building, Suite 614, Atlanta 9, Ga., Phone 873-2136, Joe H. Howell

Check 1505 opposite last page.

that's interesting

Atmosphere sniffing

. . . particularly the thin atmospheres of near space, is the purpose for which the ionization gage, shown above, was designed by Westinghouse Electric Corporation's electronic tube division.

In first solo, last November aboard an Aerobee Hi rocket, gage measured pressures and densities prevailing from 70 to 125 miles up.

Its sensitivity ranges from 1 x 10^{-3} to 1 x 10^{-10} millimeters of mercury.

Low overhead feature of light dome house

Developed for semi-permanent warehousing and similar uses, a lightweight geodesic dome structure purportedly can be heated or cooled at one-fourth the cost incurred with conventional buildings of equal size.

The dome consists of lightweight molded fiberglass panels of modular design which have sprayed-in-place urethane foam adhered to the inner sides as insulation. It can be erected in 24 hr and resists winds of 100 mph velocity.

Rockets to burn aluminum at 35-million-lb/yr rate

Aluminum powder, which increases thrust when added to solid rocket fuel, will be used at 35-million-lb/yr rate by 1965, Edward F. Reilly, Reynolds Metals Company market manager, predicts.

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☐ 1413*	☐ 1440	☐ 1467	☐ 1494
☐ 1414	☐ 1441	☐ 1468	☐ 1495
☐ 1415	☐ 1442	☐ 1469	☐ 1496*
☐ 1416	☐ 1443	☐ 1470	☐ 1497
☐ 1417	☐ 1444	☐ 1471	☐ 1498
☐ 1418	☐ 1445	☐ 1472	☐ 1499
☐ 1419	☐ 1446	☐ 1473	☐ 1500
☐ 1420	☐ 1447	☐ 1474*	☐ 1501
☐ 1421	☐ 1448	☐ 1475	☐ 1502
☐ 1422*	☐ 1449	☐ 1476	☐ 1503
☐ 1423	☐ 1450	☐ 1477	☐ 1504
☐ 1424	☐ 1451	☐ 1478	☐ 1505*
☐ 1425	☐ 1452	☐ 1479	☐ 1506
☐ 1426	☐ 1453	☐ 1480	☐ 1507
☐ 1427	☐ 1454	☐ 1481*	☐ 1508
☐ 1428	☐ 1455	☐ 1482	☐ 1509
☐ 1429	☐ 1456	☐ 1483	☐ 1510
☐ 1430	☐ 1457	☐ 1484	☐ 1511
☐ 1431	☐ 1458	☐ 1485	☐ 1512
☐ 1432	☐ 1459	☐ 1486	☐ 1513
☐ 1433*	☐ 1460	☐ 1487	
☐ 1434	☐ 1461	☐ 1488	
☐ 1435	☐ 1462	☐ 1489	
☐ 1436	☐ 1463	☐ 1490	
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☐ 1003	☐ 1036	☐ 1069	☐ 1102	☐ 1135	☐ 1168	☐ 1201	☐ 1234
☐ 1004	☐ 1037	☐ 1070	☐ 1103	☐ 1136	☐ 1169	☐ 1202	☐ 1235
☐ 1005	☐ 1038	☐ 1071	☐ 1104	☐ 1137	☐ 1170	☐ 1203	☐ 1236
☐ 1006	☐ 1039	☐ 1072	☐ 1105	☐ 1138	☐ 1171	☐ 1204	☐ 1237
☐ 1007	☐ 1040	☐ 1073	☐ 1106*	☐ 1139	☐ 1172	☐ 1205*	☐ 1238
☐ 1008	☐ 1041	☐ 1074	☐ 1107	☐ 1140	☐ 1173*	☐ 1206	☐ 1239
☐ 1009	☐ 1042	☐ 1075	☐ 1108	☐ 1141	☐ 1174	☐ 1207	☐ 1240
☐ 1010	☐ 1043	☐ 1076	☐ 1109	☐ 1142	☐ 1175	☐ 1208	☐ 1241
☐ 1011*	☐ 1044	☐ 1077	☐ 1110	☐ 1143	☐ 1176	☐ 1209	☐ 1242
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☐ 1014	☐ 1047	☐ 1080	☐ 1113	☐ 1146	☐ 1179	☐ 1212	☐ 1245
☐ 1015	☐ 1048	☐ 1081	☐ 1114	☐ 1147*	☐ 1180	☐ 1213	☐ 1246
☐ 1016	☐ 1049	☐ 1082	☐ 1115	☐ 1148	☐ 1181	☐ 1214*	☐ 1247
☐ 1017*	☐ 1050	☐ 1083	☐ 1116	☐ 1149	☐ 1182	☐ 1215	☐ 1248
☐ 1018	☐ 1051	☐ 1084	☐ 1117*	☐ 1150	☐ 1183	☐ 1216	☐ 1249
☐ 1019	☐ 1052	☐ 1085	☐ 1118	☐ 1151	☐ 1184	☐ 1217	☐ 1250
☐ 1020	☐ 1053	☐ 1086	☐ 1119	☐ 1152	☐ 1185	☐ 1218	☐ 1251
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☐ 1022	☐ 1055	☐ 1088	☐ 1121	☐ 1154	☐ 1187	☐ 1220	☐ 1253
☐ 1023	☐ 1056	☐ 1089*	☐ 1122	☐ 1155	☐ 1188	☐ 1221	☐ 1254
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☐ 1027	☐ 1060	☐ 1093	☐ 1126	☐ 1159	☐ 1192	☐ 1225	☐ 1258
☐ 1028	☐ 1061	☐ 1094	☐ 1127	☐ 1160	☐ 1193	☐ 1226	☐ 1259
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☐ 1030*	☐ 1063	☐ 1096	☐ 1129	☐ 1162	☐ 1195	☐ 1228	☐ 1261
☐ 1031	☐ 1064	☐ 1097	☐ 1130	☐ 1163	☐ 1196	☐ 1229	☐ 1262
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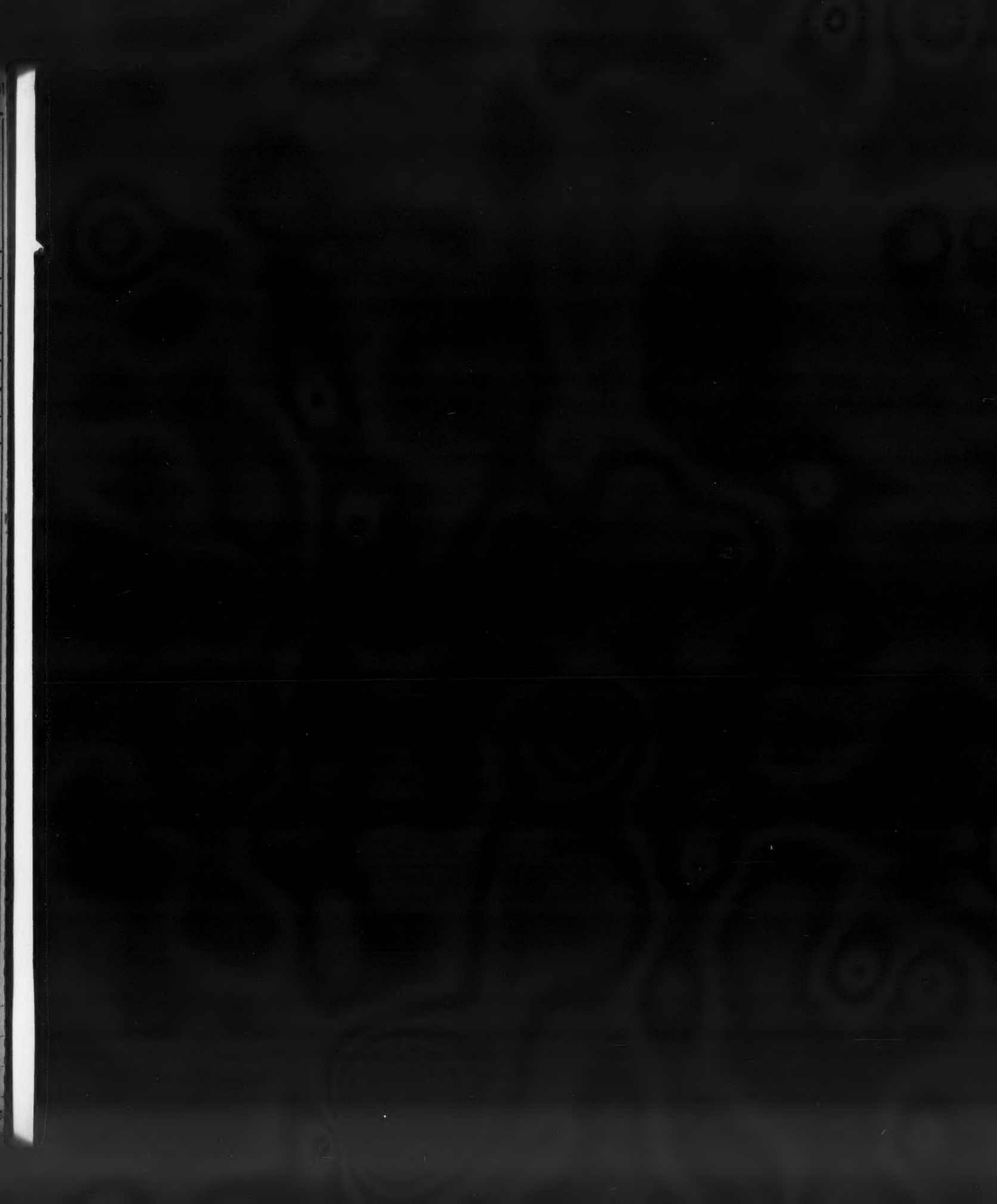

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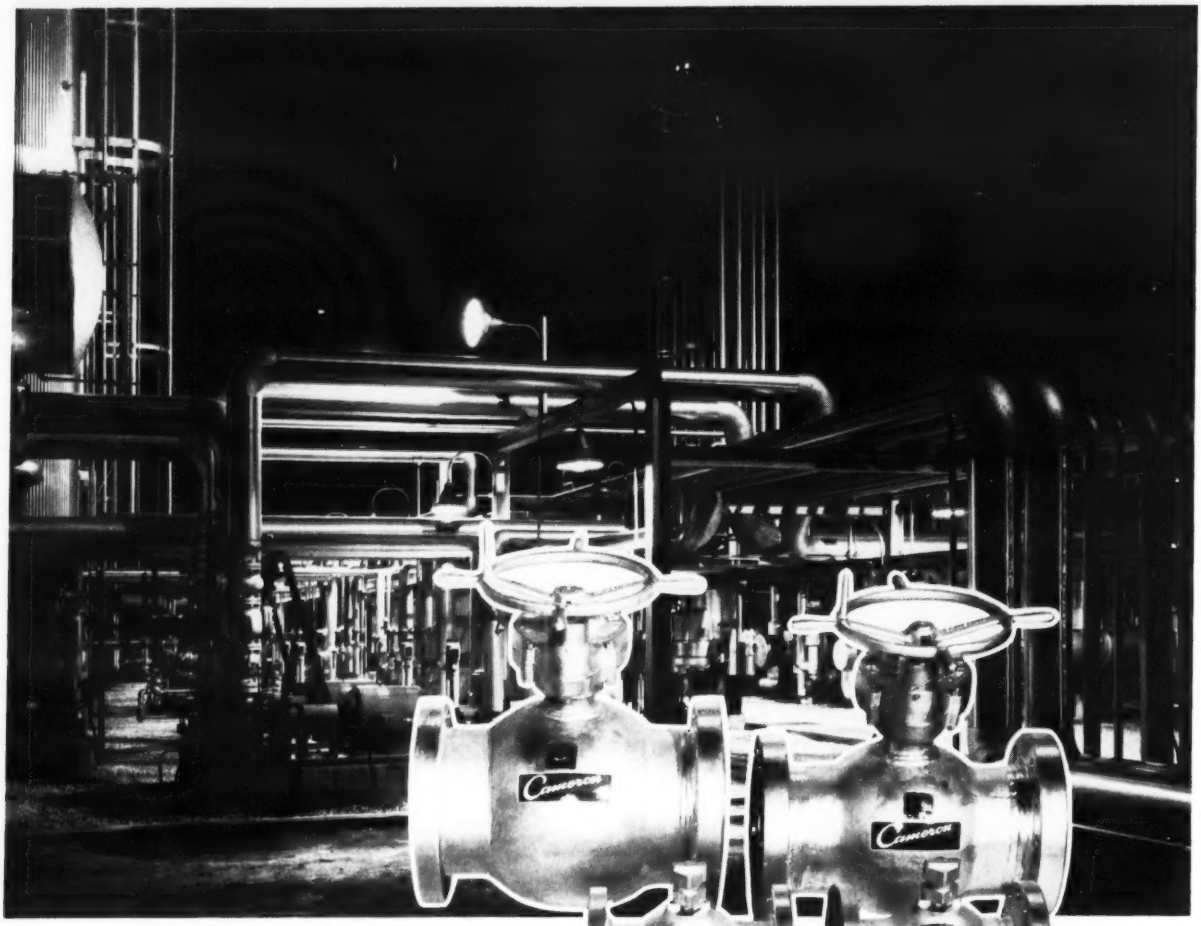

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